EQUIPMENT AVAILABILITY IN THE HOME AND SCHOOL ENVIRONMENT: ITS RELATIONSHIP ON PHYSICAL ACTIVITY IN CHILDREN

A Dissertation

by

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Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

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December 2012

Major Subject: Recreation, Park, and Tourism Sciences

ABSTRACT

Over the past three decades, instances of childhood obesity have tripled in the United States and are recognized as a serious public concern that requires action. Environmental factors have been identified as potential influences on the physical activity behavior of children; availability of equipment is one of these factors.
The overall purpose of this dissertation was to examine availability of equipment as an environmental influence on a child's physical activity behavior. The two environments where children spend the major of time, home and school, were evaluated for equipment availability and increased physical activity. Three studies were conducted to complete this purpose.

In **Manuscript 1,** a systematic literature review was conducted, which included electronic databases as well as reference lists and author's works as relevant. Only studies which measured home and school environments as factors in physical activity of children ages 5-12 were included. The review was conducted to determine the theoretical framework most used. Of the thirty-one studies reviewed, 67% showed little or no theoretical framework driving the study. Theoretical framework and models based on theory is needed to advance the field and this body of literature. In **Manuscript 2,** a systematic literature review was conducted which included electronic databases as well as reference lists and author's works as relevant. Only studies which measured home and school environments and highlighted the availability of equipment as a factor in physical activity of children ages 5-12 were included. Of the twenty-one studies reviewed, only

14% clearly defined "equipment" and how it was measured for the particular study. With multiple definitions and confusion when comparing studies, standardization in this area is desperately needed. **Manuscript 3,** analyzed data from a larger study, *NIH, Student Wellness Assessment and Advocacy Project (SWAAP),* conducted in Waller county Texas, 2010. The results demonstrated which pieces of equipment in the home environment were available and the percentage of use. School environments were measured for availability of equipment and facilities. A linear regression analysis determined that being of Hispanic race was significant in less physical activity in an average seven day period.

Given that children spend up to 80% of their day at home or school, influences in these two environments are extremely important to the development of physical activity behaviors. Future studies involving the availability and use of equipment should clearly define the type of equipment used or observed. In cases of intervention studies type and amount need to be clearly defined as well as assessment of its effect on physical activity in children.

Several studies have been conducted for the specific age group of 6-12 year olds and their physical activity and multiple factors involved availability of opportunities for physical activity. Of those factors equipment availability has been shown to influence physical activity as well as not influence these opportunities. Standardization of the term equipment and how it is measured will allow researchers to have a clearer picture of the role that equipment plays in opportunities for children to be physically active.

DEDICATION

I dedicate this dissertation to my partner and best friend Angie for her enduring support, sacrifices and understanding throughout this long process and her confidence in my ability to finish. You amaze me on a daily basis with your strength and determination on this life journey.

Also to my children, Justin, Bryce and Emily who have been supportive throughout this entire journey we have made as a family. You have been patient and encouraging through the process.

And lastly to my parents, Gene and Mary Margaret Montandon, who instilled in me the value for higher education and the love of learning, thank you for support.

ACKNOWLEDGEMENTS

I would like to thank my dissertation committee chair, Dr. Corliss Outley, for your patient ways, your guidance and your mama bear roar of motivation when needed. Your insight and unwavering support mean the world to me. Dr. Lisako McKyer, I thank for your kindness, willingness to jump on board this journey, and your time. Dr. Hodges, I thank you for being there from the beginning of my journey, as your GA, to being the last original committee member in the end. And to Dr. Witt, I owe a thank you for the chance at A&M, the youth development knowledge you passed on and the growing experience we achieved together. To Dr. Marlene Tappe thank you for your willingness, patience, and knowledge to assist me with the data analysis for this study.

Dr. Joy Joyner for all your motivation, encouragement and friendship over these last 24 years. You have been a great mentor and an even better colleague.

Kevin thanks for all your support over these years. You have been a big part of my life and I appreciate all you have done for me.

To my guest editors, Gene, mom and Lynn B., thanks for your quick turn around and suggestions that helped with the finished product. Your constant willingness to read a page another page after another will not be forgotten.

To the peers in the grad lab that made this journey possible at A&M, Stephanie, Sherri, Michael, Carin, Megan, Holly, Cat, Andrew, Sandy, and Kindal; my College Station friends Kathy, Cathy, Lorraine and Deter, you made my experience amazing with many memories and friendship developed.

A very special thanks to my family Angie, Justin, Suni, Bryce, Emily, Matt, Kevin, Mom, Gene, Gma Betty, Cindy, Duffy, Mama Mack, Kyle, Kim, Will, and Ilee, for all your support and encouragement along the way. I couldn't have nor would I have wanted to try and do this without you all. I love you all so much and I am forever grateful for your love and support.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

CHAPTER I

INTRODUCTION

Play begins in childhood. Opportunities for play and physical activity (PA) have decreased over the past decades as our environments have changed. Children are experiencing inactivity from an early age. We are a modern society with automation that decreases our energy expenditure from the past three decades. It is this world of inactivity that children are starting their lives and it is in the same three decades that the health condition of obesity has become an epidemic.

FACTORS THAT INFLUENCE OBESITY

Obesity is a multi-factor health condition involving interactions of the environment, genes, and lifestyle (Hume, Salmon, & Ball, 2005). Other factors suggested to contribute to obesity include metabolic problems, certain medicines, genetic and family history factors, smoking, emotional factors, stress, age, lack of sleep and social factors (Flegal, Ogden, Wei, Kuczmarski, & Johnson 2001;Trost, Kerr, Ward, & Pate, 2001). Genetics, metabolic, behavioral, and environmental factors all interact to influence physical activity behaviors in children contributing to weight maintenance. Because of the rapid rise in obesity, it is thought that behavioral and environmental influences, specifically increases in physical inactivity, strongly contribute to the epidemic (Owen, Humpel, Leslie, Bauman, & Sallis, 2004).

Insufficient amounts of PA are hypothesized to be an important contributing factor in the overweight and obesity epidemic, which is compromising the health of

adults and children in the U.S. (Craggs, Corder, van Sluijs, & Griffin, 2011;Kimm et al., 2000). Currently, the majority of children and adolescents do not meet the recommended daily physical activity and an estimated one in three American children are overweight or obese (AHA, 2010) Pre-adolescence, which is defined as the period between childhood and adolescents, approximate ages of 9-12, is a pivotal time to influence health related behaviors to control problematic eating and physical inactivity habits contributing to obesity. Childhood years are crucial for the development of healthy behaviors leading to healthy outcomes that continue through adulthood.

Twenty years ago diseases once observed only in adults, such as cardiovascular disease, dyslipidemia, type II diabetes and nonalcoholic fatty liver disease (Berenson, Srinivasan, Bao, Newman, Tracy, & Wattigney , 1998; Flegal et al., 2001) have now become health problems treated by pediatricians. The importance of health interventions that reduce the occurrences of overweight and obesity in children continuing through adulthood have the potential to be remarkable. Success has been moderate despite recognition of the numerous risk factors associated with overweight and obese clinical interventions. One particular area of focus for interventions is increasing physical activity among children.

Physical Activity

With the potential that habits and patterns of behavior developed in childhood that are related to physical activity may carry through to adulthood, it becomes essential to understand the correlates and determinants of these behaviors. If we were to identify the most influential determinants, this knowledge would allow for the development of

interventions and lifestyle changes in promoting physical activity on a continuum from childhood through adulthood.

Physical activity participation in children and adolescents has been shown to differ by demographic characteristics such as race/ethnicity (Corder, Sallis,Crespo, & Elder, 2011; McKenzie et al., 2008a), age (Ogden, Wei, Curtin & Flegal, 2010; Trost et al., 2001), gender (Durant et al.,2009; Sallis, 2009), and socioeconomic status (SES) (Ridgers, Saint-Maurice, Welk, Siahpush, & Huberty, 2011). Gender differences in physical activity have been established in numerous studies. The majority of these studies found higher participation rates in physical activity in boys more than girls in the children and adolescent population (Lindquist, Reynolds, & Goran, 1999; Sallis, Bauman, & Pratt, 1998).

Physical activity (PA) has many benefits. Psychologically, PA offers emotional benefits including stress reduction, increased self-esteem and lower anxiety(Ahn & Fedewa, 2011). Physical benefits of PA can include stronger bone and muscle structure, cardiovascular system strengthening(Janssen & LeBlanc, 2010), increased immunity system and increased blood flow to vital organs including the brain (Brockman, Jago, & Fox, 2010; Ridgers et al., 2011). With increased blood flow to the brain children have the ability to concentrate, including at the end of the school day (Chomitz et al., 2009; Singh, 2012).

National recommendations state that children should engage in either 20 minutes of vigorous exercise three days per week or 30 minutes of moderate exercise five days per week (AHA, 2010). Vigorous physical activity includes exercise or activities that

make one sweat and breathe hard, such as running, basketball, soccer, or similar aerobic activities. Moderate physical activity includes activities that do not make one sweat and breathe hard, such as fast walking, slow bicycling, or skating.

In a review by Sallis, Prochaska and Taylor (2000), significant psychosocial and socio-demographic correlates of physical activity in children were identified including gender, parental weight, perception of barriers, previous physical activity, healthy diet, program access, and time spent outdoors. For adolescents, correlates were similar with the addition of perceived competence, intention, depression, previous physical activity, community sports, sensation seeking, and parental support (McAlister, Perry & Parcel, 2008; Perry, Saelens, & Thompson, 2011;Sallis et al., 2006). These findings have since been strengthened with multiple studies on the social and environmental correlates and determinants associated with PA in youth and children (Ogden et al., 2010;Singh, 2012).

Home Environment

It has been suggested that the home environment for children under the age of 12 years is a critical component for opportunities of PA despite being the least accessible for health promotion efforts (Kumanyika, 2008). Parents are considered to play a key role in the development of a physical activity routine.

Parental support in the home environment can range from encouraging a child to participate in physical activity, to providing access (transportation) to an activity class or program, to decreasing television time, to purchasing sport equipment.

In addition, the home environment can shape physical activity behavior and how children spend their leisure time. One such way is the presence or absence of sport or

play equipment, yard space and the proximity to recreation facilities. (Salmon, 2010). The access or presence of sport or play equipment in or around the house is associated with increased physical activity (Corder et al., 2011; Huang, Wong, Salmon, & Hui, 2011; Trost et al., 2001; Spurrier, Magarey, Golley, Curnow, & Sawyer, 2008; Stucky-Ropp & DiLorenzo, 1993; Timperio et al., 2008). Furthermore, when more social media equipment are available, children are more likely to engage in these types of sedentary activities (Salmon,& Okely, 2009). Exercise equipment in the home was also found to be positively related to physical activity, particularly in adolescent girls (Sallis, Johnson, Calfas, Caparosa, & Nichols, 1997).

Much of children's play time occurs in their yards, (Veitch, Bagley, Ball & Salmon, 2006) and time spent outdoors is associated with physical activity (Sallis et al., 2000). Several studies have suggested that outdoor play space is important for physical activity and that the availability of safe and convenient home-based recreation opportunities promote physical activity (Salmon, 2010; Sallis et al., 2009).

As well as the environment being a factor is the availability and type of equipment in that home environment. Specific types of equipment have been associated with increased PA in the literature; bikes (Bryant, et al., 2008) size of back yard with play structures (Salmon, 2010; Spurrier et al., 2008).

School Environment

Another environment that contributes to increased physical activity among children is school. Through physical education, physical activity is promoted and children are enabled to participate (Durant et al., 2009; McKenzie, Thomas, & Kahan

2008b: Sallis et al., 2000). Gordon-Larsen, McMurray & Popkin (2000), found that participation in school physical education was significantly associated with engaging in moderate to vigorous physical activity for a nationally representative sample of over 17,000 adolescents ages 11 to 21. However with changes in curriculum and budget cuts, physical education classes have been reduced. Schools present other opportunities for physical activity throughout the day including recess, break time, intermural sports and availability of fields and facilities after school hours.

An important component of the school environment is also the availability of school play equipment, facilities, fields and courts (Beighle, Morgan, LeMasurier & Pangrazi, 2006; Sallis et al., 2006; Verstraete, Cardon, De Clercq, & De Bourdeaudhuij, 2006). In several studies, the examination of the effect of playground markings showed a significant increase in moderate to vigorous physical activity in the schools with playground markings and renovated play structures (Haug, Torsheim, Sallis, & Samdal, 2010; Ridgers, Fairclough, & Stratton, 2010a). And a combination of renovated playgrounds with additional equipment lead to a significant increase of Moderate to Vigorous Physical Activity (MVPA) in both boys and girls (Howe, Freedson, Alhassan, Feldman, & Osganian, 2012). The playground markings included hopscotch, football and basketball out of bounds lines. Opportunities for school based physical activity have shown to have positive influence on the PA behaviors on active and non-active children (Zask, van Beurden, Barnett, Brooks, & Dietrich, 2001;Willenberg et al., 2010). These school based opportunities have been enhanced by the presence of equipment (Veitch et al., 2006).

With the addition of equipment so successful in involving kids during recess, a couple of recent studies combined increased equipment availability as well as playground leaders to provide more structure to the activities. Both studies found that the addition of a "facilitator" to encourage play was significantly associated with the increase in PA during recess (Huberty et al., 2011; Timperio et al., 2008).

Currently, the majority of children are not meeting the recommended 60 minutes of MVPA daily. However in daily recess and leisure periods before school and after lunch, children have been shown to achieve up to 50% of this recommended MVPA. (Corder et al., 2011; Durant et al., 2009)

CHALLENGES REGARDING EQUIPMENT

Given the recognized importance of the presence of equipment within the home and school environments of children to improve physical activity, the absence of theory-driven research is surprising. For studies that have drawn on well-defined and accepted environmental theories for study design, there is a lack of conceptualization in the literature as well.

First, researchers must provide a more holistic theoretical framework based on the constructs measured. Researchers should highlight and outline the theories used to develop the study. The term "theory" refers to a set of general laws that has been established by empirical research and are formulated to explain and understand phenomena within an area of study. Theories are systematic in nature and help with understanding behaviors and situations and help a research generate hypothesis and interpret results. Theories are like a road map for studying behaviors and it provides the

foundation for conceptual models, consisting of the behavior of interest and the factors that explain that behavior, the ways in which these variables are defined, and the assumed relationships between them. The conceptual models are in turn used to guide the research effort, including the research design, the measurement of variables, and the analysis that follows. With so few studies using a theoretical framework, how developed is our body of knowledge? How solid are our interventions or evaluations? Research driven by a theoretical framework, though use of application of the theory, and testing of behavior needs to be applied to advance this field of study.

Secondly, research must conceptualize the key variable under study, equipment availability. Throughout the literature of children and physical activity there have been very few studies that focus primarily on the impact of equipment availability and of those studies, the variable "equipment" is not standardized. This variable has multiple measurements and researchers must consider which measurements are likely to be linked to physical activity and ultimately lead to its increase.

The context of equipment availability and its relationship to physical activity is becoming a growing concern in the field and has various health implications. As researchers search for strategies to increase physical activity among children, the field has come to a realization that these sociological environments may hold the potential for a sustained low-cost intervention. However, the major concern is *what types of equipment will help to increase physical activity among children?* The interest in the role of equipment availability and physical activity is relatively new, and the need for examining and deciding upon a suitable theory and appropriate ways to conceptualize

the primary variable is still warranted. Thus, theory is the starting point for meeting both of the research challenges posed above: thinking more broadly about the theoretical frameworks that guide current research into this issue and thinking more specifically about the conceptualization of the key variables.

OVERALL GOAL OF THE STUDY

The objective of this study was to answer the following: (a) What theoretical concepts and models are driving the literature on factors, specifically equipment, and its relationship to PA in children age 5-12 years old in their home and school environments. (b) How is "equipment" defined in the literature (c) Using secondary data what are the significant factors in the physical activity levels of fourth graders?

Aim 1: Investigate the theoretical framework and models currently driving the literature of equipment and its relationship to PA in children ages 5-12 years old in their home and school environment

Both research and theory have highlighted many connections between children's home and school environments and their physical activity behaviors. Theory, research and practice are intertwined. Theory guides research which guides practice, which may produce findings that make it necessary to refine the theory (DiClemente, Crosby, Kegler, 2002). Theories can vary in conceptually development and testability. It is the testability that allows for development of models and research. Therefore it is vital that studies are grounded in theory and a framework/model is tested in order to apply generalities to larger populations. A significant amount of research has occurred on PA in children and their environments of the school and homes. Within these studies many

factors have shown an association with an increase in physical activity. Many of these factors are components of the home and school environment.

Aim 2: Clarification of "equipment" as defined/operationalized in the literature

The second research question seeks to clarify the use of the variable, "*equipment",* in the literature. While study may include *"equipment*" as a factor/correlate of PA in children, how is it defined? Is there a standardization that allows researchers to compare study results? There are inconsistencies in the literature with regards to addressing the definition of equipment, and availability of equipment in the home and school environment, particularly the home environment.

Aim 3: Using secondary data what are the significant factors in the physical activity levels of fourth graders?

Based on current studies, several factors including race, gender, and equipment availability are significant in the PA behaviors of children 5-12 years of age. Will these same factors be significant in the population studies in regard to equipment availability and usage?

Results from these research questions will help bridge the gap in the studies of PA in children and the relationships of factors in their home and school environment-specifically equipment availability as a factor. Findings from this will provide a catalyst to standardize the use of "equipment" as a variable in PA behaviors and increase awareness of the importance of theory, framework and models for strategies in developing interventions for children to increase their PA.

Given the limitations of the current academic literature, this dissertation includes two systematic reviews and one primary study. Several steps were taken to approach this issue.

SUMMARY

The current dissertation was written using the integrated-article format, in which each chapter represents a separate manuscript that focuses on the home and school environmental influences on children and their physical activity behaviors The format is comprised of 5 chapters.

A primary systematic review was essential in order to provide an inclusive assessment of the current research to date and to identify specific areas requiring clarification. The first manuscript titled *"Theory Utilization Among Studies of Environmental Factors Influencing Physical Activity in Children Ages 5-12: A Systematic Literature Review"* (Dissertation Chapter II) efficiently addresses this issue. Through a systematic literature review, use of specific theories, frameworks, models or lack thereof are highlighted and rated. The resulting manuscript reveals conceptual and methodological gaps. Other results of the systematic review include developmental concerns regarding reviewed studies. For example, the majority of studies were completed with little or no theory, framework or model present. This article presents recommendations for future study to improve this growing field of study. This manuscript will be submitted to the Journal of Physical Activity and Health.

The second systematic review was required to provide confirmation how measures of equipment, were defined conceptually in order to assess the home and

school environment that contribute to a child's physical activity. The second manuscript titled "*Exercise, Sport and Athletic Equipment (ESAE) in the Home and School Environment: A Systematic Literature Review"* , (Dissertation Chapter III) effectively confirms the inconsistencies in the literature. Not only are the inconsistencies highlighted in the body of literature confirmed but inconsistencies within single articles on multiple definitions of the same piece of equipment. This article will also present a standardized set of descriptive terms for equipment to be used in future studies. This manuscript will be submitted to Pediatric Exercise Science.

Finally, through the use of secondary data, an analysis was conducted to examine the relationship/association between equipment availability and usage at home and school and child physical activity levels. In the third manuscript titled *"Equipment Availability and Usage in the Home and School Environment: Is There a Relationship to Physical Activity in Children?"* (Dissertation Chapter IV), environmental factors influencing PA in children, including equipment availability, will be analyzed for the population of fourth graders. This manuscript will be submitted to Health and Place. These findings will add to the body of knowledge and recommendations for future studies will be presented.

All three manuscripts are standalone articles and are formatted and referenced in the style of each individual journal. Chapter 5 includes additional findings from each manuscript not cover in the individual chapters as well as overall study implications to the field. Tables and figures will appear throughout each individual manuscript.

CHAPTER II

MANSCRIPT 1: THEORY UTILIZATION AMONG STUDIES OF ENVIRONMENTAL FACTORS INFLUENCING PHYSICAL ACTIVITY IN CHILDREN AGES 5-12: A SYSTEMATIC LITERATURE REVIEW

INTRODUCTION

There is increasing interest in the role that home and school environments play in shaping the PA behaviors of children, specifically in the context of overweight and obese children The environment refers to all that factors that can affect a person's behavior that are external to him/her (Baranowski, Thompson, DuRant, Baranowski, & Puhl,1993).

The physical environment includes things such as the home environment, school, availability of resources, and numerous other physical factors. Social influences are another type of environmental influence. Environmental influences are important in health promotion efforts, as aspects in the environment, such as parental and peer influences, provide opportunities and support for behaviors.

The physical environment includes things such as the home environment, school, availability of resources, and numerous other physical factors. Social influences are another type of environmental influence. The home environment has been suggested to be critical in providing opportunities of physical activity for children under twelve within the home environment (Kumanyika, 2008; Spurrier et al., 2008). Children participate in more physical activity when equipment is available (DiLorenzo, Stucky-

Ropp,Vander Wal, & Gotham, 1998; Sallis et al., 1997; Stucky-Ropp & DiLorenzo, 1993; Timperio, Crawford, Telford & Salmon 2004; Ziviani et al., 2008).

Many school-based programs have been successful in increasing physical activity levels of youth (Pate, Trost, Felton, & Ward, 1997). These programs are typically offered during health and physical education class, and include programs such as Sports, Play, and Active Recreation for Kids (SPARK) (Sallis et al., 1997), the Cardiovascular Health in Children study (CHIC; Harrell, McMurray, Gansky, Bangdiwala, & Bradley 1999), and the Child and Adolescent Trial for Cardiovascular Health (CATCH Trial; Sallis et al., 1998). In recent years, inventions during recess have become a focus (Erwin et al., 2012; Ridgers, et al., 2010a; Ridgers et al., 2011; Willenberg et al., 2010).

An overview of environmental factors associated with PA among children is needed. A detailed understanding of these factors is essential in understanding PA behaviors in children so that effective interventions can be created. With the use of a theoretical framework in a study we can clarify observed behaviors that are consistent with a population. Theories help to explain causal relationships between individuals and their behaviors. These relationships can then be predicted when other groups of individuals exhibit the same types of behaviors or set of conditions.

The purpose of this systematic review was to gather, assess and evaluate studies examining PA behaviors in children, ages 5-12, in relation to their home and/or school environment(s). The front and back yard, the court or street in front of the home as well as the household interior comprise the *home environment*. *School environments* include areas where unstructured PA will be included such as before and after school PA,

however not in an organized program, school grounds on weekends and recess. Specifically, the review will focus on the theoretical framework of the studies and the different factors/constructs that are utilized while looking at these environments. Theories are used in the development and evaluation of behavior interventions. Research driven by a theoretical framework, though use of application of the theory, and testing of behavior needs to be applied to advance this field of study. A theoretical framework is a statement of assumptions that when read allows the reader to evaluate them critically. By articulating the theoretical assumptions of a study, the researcher is able to more from describing an occurrence that is observed to making generalizations. If a link to home and/or school environments can be established as increasing PA in children, specific interventions that take place at home or school can be established to change the lack of PA. The review aimed to address the following specific research questions:

(i) Which theories are utilized most frequently among research in this area?
(ii) Within the theoretical contexts, which factors/constructs are utilized most frequently?

METHODS

Search Procedures

The review sought to identify all studies that examined the relationship between home and/or school environments and a specific outcome of PA behavior in children (age 5-12). Cross-sectional, experimental results and longitudinal studies were included. Longitudinal studies were included if the age limits were consistent with the inclusion criteria, however if the age range exceeds the criteria, only the baseline measurements

within the age range would be used. Dissertations, qualitative studies, and expert opinions were excluded from the review.

Studies were located from four sources. First, searches of the electronic databases Academic Search Premier, ERIC, Sport DISCUS, Science Direct, and Physical Education Index (English Language versions) were conducted for the time period from January 1980 to March 2012. Search terms included, *physical activity, youth, children, child, school, home environment, equipment, recess, parents, sport, exercise, free play, play, perceived environment* and *family.* These terms were derived from a compilation of the terms used in previous reviews and were selected to limit studies to children and adolescents. The truncation symbol was used in the search to ensure all terms were identified. Second, a manual search was performed, for the same time period, in the following journal titles: *American Journal of Health Promotion, American Journal of Public Health, International Journal of Behavioral Nutrition and Physical Education, International Journal of Obesity, Journal of Leisure Research, Journal of Park and Recreation Administration, Journal of Physical Activity and Health, Journal of Science and Medicine and Sport, Leisure Sciences, Leisure Studies,* and *Preventive Medicine*. These titles were included for manual searches as the majority of studies identified from electronic searches were published in these titles. Third, to identify previously unidentified studies, purling of the references lists of review studies and articles included in the review were screened for titles that included the key terms. Fourth, individual author's personal files were reviewed for articles previously unidentified through the search process. An experienced research librarian validated the search. After potential

articles were reviewed through titles and abstracts, full text copies of the articles fitting the selection criteria were retrieved.

Inclusion/Exclusion Criteria

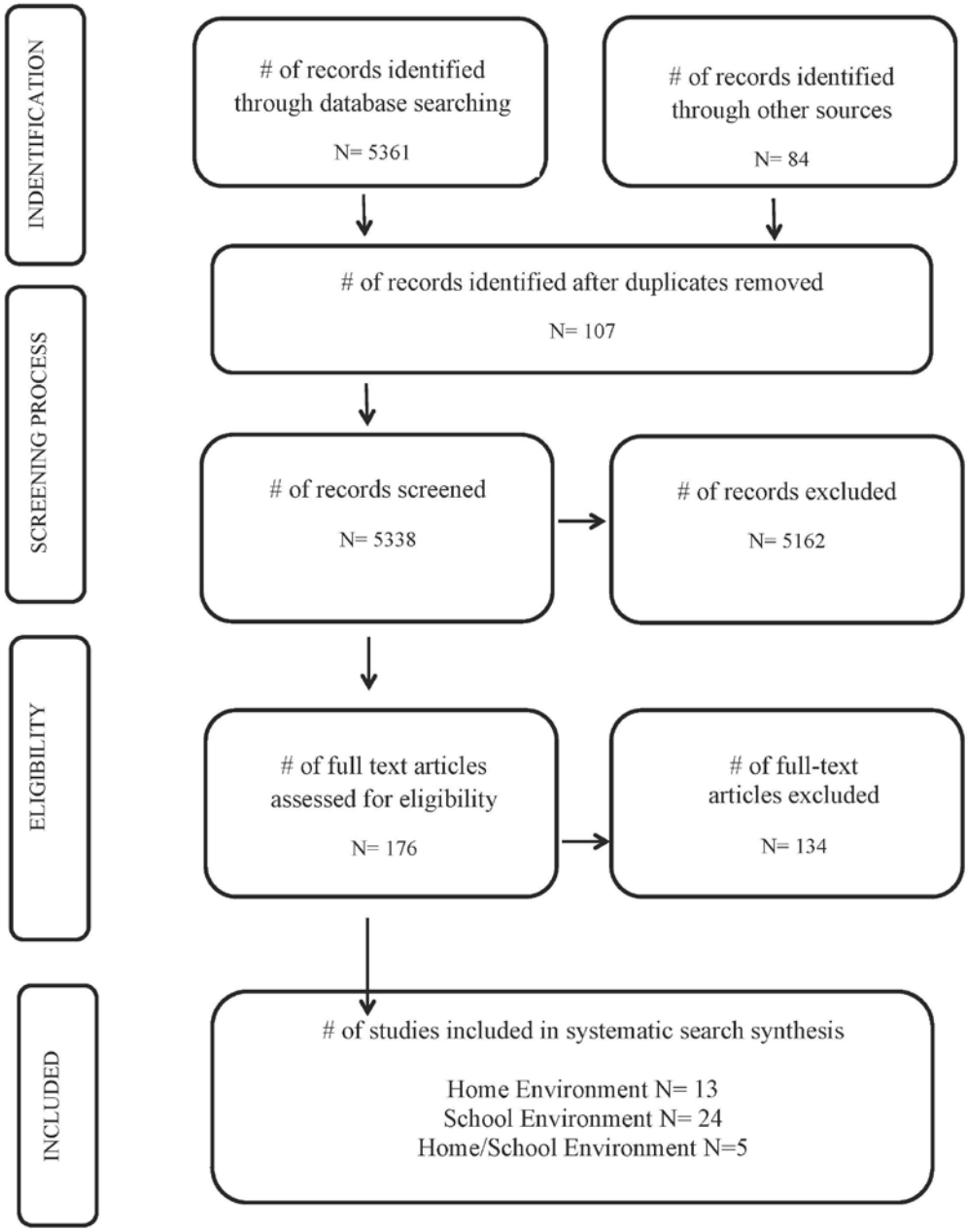
A study had to meet the following criteria to be eligible for inclusion: (a) appear in an English language peer-reviewed journal; (b) Meet study criteria; (c) target elementary aged children (5-12 years of age) and /or their parents; and (d) focus primarily on PA and environments; e) study occurred in a developed country and f) measured environmental factors contributing to PA as the dependent variable. Studies were excluded if they (a) were not research articles, (b) were focused on "built environment" of school, (c) focused on environments other than home or school, (d) if the population was older or younger then elementary age children (5-12 years), and (e)if the focus was on structured PA (i.e. Physical Education class).

Recording and Synthesizing Results

The preliminary search of electronic databases produced 5361 potential relevant articles. After a review of reference lists and author personal files another 84 potential relevant articles were identified (Figure 1).

Elimination of duplicates with EndNote X5 (Thomson Reuters) reference manager software and any remaining duplicates were removed manually resulted in 107 studies removed. Screening of titles and abstracts resulted in 176 articles for full text review using the previous stated exclusion criteria. After reviewing the full-text of these studies, only 42 studies met the inclusion criteria, thirteen relating to the home environment and twenty-four relating to the school environment.

Figure 1: Exclusion/Inclusion process study 1



Five studies assessed both the school and home environment as a part of their studies. Main reasons for exclusion of full-text articles were; population age of the sample (83); study was a duplicate of a previously excluded study (9); environment was not school or home (22); study did not measure environmental factors contributing to PA as the dependent variable (9), and studies with multiple exclusion criteria (22).

All articles were given an identification number in the database prior to review. For each study, the following were recorded: (a) first author and year published; (b) study design; (c) methods used in study; (d) population involved; (e) number of participants (N); (f) theoretical framework; and (g) theory utilization score. The author recorded the information and cross-checked to identify any validation issues.

Findings from the studies were reviewed and scored for theory utilization. To evaluate the theory utilization, the author used an instrument adapted from Delissaint and McKyer (2008). Studies were rated based on the use and existence of theoretical framework. See Table 1 for more details.

Table 1 Criteria for assessing studies' theory utilization

Criteria	Description	Score
Theory Utilization	Clear identification/operationalization of theory	3
	Use of theory but inferred (not clearly identified)	2
	Some evidence of use of theory/constructs	1
	No evidence of theoretical basis driving research	0

Adapted from Delissaint and McKyer (2008)

Table 2 summarizes the study characteristics including lead author and year; study design; location; population description and number; environment measured; PA measurement; theoretical framework if available; and the theoretical utilization score based on the criteria in the adapted instrument in Table 1.

RESULTS

Forty-two publications were identified that presented an association or measurement of equipment as an environmental correlate of PA in children. The two environments that were assessed were the home and school environment. The majority of the studies (83.3%) were published in the past decade, with almost three fourths (74.2%) of those studies published in the past five years (2008-2012). The majority (78.6%) of the studies used a cross sectional design for the study, while a little over half (52.3%) were conducted in the United States, and just over a third (38%) used some form of self-reporting from children and parents. Observation and measurement using accelerometers and pedometers made up the other 62% of the PA assessment.

Table 2: Summary of studies and their theoretical utilization score

Reference	Study type	Setting	Population	# of participants	Environment	PA measurement	Theory/Model Present	TUS
Adkins et al. (2004)	CS	USA	8-10 yr girls	52	H	PP SR	SCT	2
Anthamatten et al. (2011)	CS	USA	6-11 yr.	3688	S	OB	NA	0
Beighle et al. (2006)	CS	USA	3rd-5th grade	270	S	M	NA	0
Bryant et al. (2008)	I	USA	3-8 yr.	85	S	M	NA	0
Corder et al. (2011)	CS	USA	5-8 yr.	541	H S	M PP	NA	0
Crawford et al. (2008)	CS	AUS	K-6th grade	175	S	PP SR	SEM	1
DiLorenzo et al. (1998)	L	USA	5th-6th grade	111	H	PP SR	SLT	2
Dzewaltowski et al. (2010)	CS	USA	4th-6th grade	110	S	SR	SCT	3
Erwin et al. (2012)	CS	USA	3rd-5th grade	160	S	M OB	NA	0
Farley et al. (2008)	CS	USA	K-8th grade	1063	S	OB	SEM	1
Haug et al. (2010)	CS	NOR	K-6th grade	9613	S	SR	SEM	3
Howe et al. (2011)	CS	USA	3rd grade	45	S	M OB	NA	0
Huang et al. (2011)	CS	CHI	9-14 yr.	303	H	PP	SEM	2
Huberty et al. (2011)	CS	USA	3rd-5th grade	93	S	M	SEM	3
Hume et al. (2005)	CS	AUS	10 yr. olds	147	H S	SR	SEM	3
Jones et al. (2010)	I	UK	9-10 yr.	2064	S	M	SEM	3
Lopes et al. (2009)	CS	Portugal	6-12 yr.	158	S	M	SEM	0
Lousaides et al. (2004)	CS	Cyprus	6th grade	256	H S	PP SR	SEM	2

Table 2 con't:

Reference	Study type	Setting	Population	# of participants	Environment	PA measurement	Theory/Model Present	TUS
Lousaides et al. (2009)	I	Cyprus	5th-6th grade	247	S	M	NA	0
McKenzie et al. (2010)	CS	USA	Play Areas	137	S	OB	NA	0
McKenzie et al. (2008)	CS	USA	K-2nd grade	139	S	OB PP	SEM	1
Nielson et al. (2012)	CS	Denmark	6 and 10 yr.	704	S	M OB	NA	0
Pate et al. (1997)	CS	USA	5th grade	558	H S	SR	SCT	1
Ridgers et al. (2005)	CS	UK	K-5th grade	147	S	M	SEM	0
Ridgers et al. (2007)	L	UK	K-5th grade	470	S	M OB	NA	0
Ridgers et al. (2010)	I	UK	K-5th grade	256	S	M	NA	0
Ridgers et al. (2010)	CS	UK	9-10 yr.	152	S	M OB	SEM	1
Ridgers et al. (2011)	CS	UK	3rd-6th grade	257	S	M	NA	0
Roemmich et al. (2007)	CS	USA	8-12 yr.	110	H	M PP SR	SCT	2
Saint-Maurice et al. (2011)	MM	USA	3rd-5th grade	100	S	M OB	NA	0
Sirard et al. (2008)	I	USA	Families	10	H	SR	NA	0
Stucky-Rupp et al. (1993)	Q	USA	5th-6th grade	242	H	PP SR	NA	0
Taylor et al. (2011)	CS	New Z	K-5th grade	473	H S	M	NA	0
Telford et al. (2011)	CS	USA	5-6 / 10-12 yr.	291/919	H	M PP	NA	0
Timperio et al. (2008)	CS	AUS	10-12 yr.	919	H	M PP	SCT	2
Trost et al. (1997)	CS	USA	5th grade	229	H	SR	SCT	1

Table 2 con't:

Reference	Study type	Setting	Population	# of participants	Environment	PA measurement	Theory/Model Present	TUS
Trost et al. (1999)	CS	USA	6th grade	119	H	M	SCT	2
Trost et al. (2001)	CS	USA	6th grade	213	H	M SR	SCT	2
Veitch et al. (2006)	CS	AUS	1st-6th grade	78	H	PP	SEM	3
Verstraete et al. (2006)	CS	Belgium	5th-6th grade	235	S	M OB	NA	0
Zask et al. (2001)	CS	AUS	K-6th grade	3912	S	OB	NA	0
Ziviani et al. (2008)	CS	AUS	2nd-3rd grade	318	H	PP SR	SEM	1

Abbreviations: CS= Cross-sectional, H= Home, I= Intervention, L= Longitudinal, M= Measured, MM= Mixed-methods, NA= Not Applicable, OB= Observational, PP= Parental perception, Q= Qualitative, S= School, SCT= Social Cognitive Theory, SEM Social Ecological Model, SLT= Social Learning Theory, SR= Self-reported

School Environment

Of the studies included in the review associated with school environment, six *were renovations or improvements of the physical playground environment*, through repainting playground lines and other space improvements within the school grounds (Anthamatten et al.,2011; Lopes, Rodrigues, Maia, & Malina, 2011; Ridgers, Fairclough, & Stratton, 2010b; Ridgers, Stratton, Fairclough, & Twisk, 2007a; Taylor, 2011): six were an *increase of equipment* Erwin et al., 2012; Farley, Meriweather, Baker, Rice, & Webber, 2008; Huberty et al., 2011; McKenzie, Crespo, Baquero, & Elder, 2010;Verstraete et al., 2006); and seven *measured PA during recess and its contribution towards the daily combined MVPA* (Beighle et al., 2006; Haug et al., 2010; Nielsen, Bugge, Hermansen, Svensson, & Andersen, 2012; Jones et al., 2010; Loucaides, Jago, & Charalambous, 2009; Nielsen et al., 2012; Saint-Maurice, Welk, Silva, Siahpush, & Huberty, 2011;Zask et al., 2001).

School Playground Improvements

Of the six studies that focused on school playground improvements, all six scored a zero in theory utilization. Anthamatten et al., 2011, the one American study, focused on the lack of adequate environmental support due to SES factors in neighborhoods that were poor and had a high percentage of minorities. Children's PA during recess was monitored through observation on newly renovated playgrounds (new stationary equipment and painted play areas).

This study showed no association of equipment and increased PA. Of the remaining five studies, Ridgers (2007a, 2007b, 2010a and 2010b) observed examined

elementary aged students in the UK grades 3-6th with a sample size of 800 between studies. Similarities in these studies included more MVPA in boys than girls, PA measurements were conducted with accelerometers and equipment was shown to affect PA positively. Taylor et al., 2011, focused on the same population elementary school children with a sample size of 441 using an accelerometer to measure PA. Louicades et al., 2009 focused on 6th grade students in Cyprus as the other studies but also included the element of teachers involved in activities as well as renovations.

Similarities in these five studies included lack of theory utilization, measurement of PA through accelerometer readings, and newly painted and reutilized playgrounds. With exception of the New Zealand study, PA increased with playground improvements that included freshly painted colored lines, play structured replaced and the addition of balls, jump ropes and other miscellaneous small pieces of "portable equipment". Playgrounds were defined as "equipment" in these studies as well as the other small pieces.

Equipment Utilization

Areas that had more "installed" play equipment instead of open grassy play field resulted in 3-12% increased PA during recess as observed through a two year study, however no theoretical framework was provided (Farley et al., 2008). Two studies observed equipment usage such as "loose equipment" (balls, bats, and jump ropes for example) and its tie to increased MVPA while utilizing a brief theoretical framework of the Social-ecological model (SEM) (Ridgers, Fairclough, & Stratton, 2010b) and no theoretical framework (Verstraete et al., 2006). Ridgers et al. (2010b) observed a

population of 5thand 6th graders (n= 228) while Verstraete et al. (2006a), observed 5th graders (235). Both studies indicated an increase in PA with the availability of the "loose equipment" as described in the literature as balls, bats, jump ropes and flying discs as examples. SEM was utilized in observed role modeling of playground attendants and other students in the Ridgers, (2010) study. Playground attendants were instructed to provide a role model of PA and encourage students to participate. Attendants were also instructed organize activities in areas populated by students being inactive. Girls had increased MVPA during recess that included these attendants and their interventions.

Contributions of Recess

Recess is an unstructured time for play happening daily and in some elementary schools, twice a day. During this unstructured time studies have suggested increased minutes of MVPA take place due to lack of rules and availability of activities. Studies measured number of steps taken in a fifteen minute time period (Erwin et al., 2012) and found that up to 50% of the suggested MVPA in children could be obtained through recess. In two studies, differences in PA levels during recess by gender, ethnicity, and grade (Ridgers et al., 2011), and by gender in her 2007 study (Ridgers, Stratton, Fairclough, & Twisk, 2007b) were observed.

Ridgers surmised that interventions targeted at girls through their environments could increase the amount of MVPA achieved on the playground during recess. Analysis of the data supported the hypothesis with equipment having a strong association in the increase. Also measuring the gender differences of MVPA through observation and accelerometer readings, Saint-Maurice et al., 2011, concluded similar findings in the

increased MVPA in girls. There was a significant increase in MVPA in girls (30%) when equipment and supervision were implemented; however the boys increased their MVPA as well (43%) (Saint-Maurice P., et al., 2011). In their 2010 study, Haug et al., the strongest SEM theoretical framework emerged citing the environmental factors associated with the increase in MVPA on the school playground and the importance of these factors for further interventions during the school day. An increase of MVPA minutes was apparent with the playground changes.

Home Environment

Sixteen studies focused on the home environment or a combination of home and school environment, nine of the studies focused on *parental perceived environments factors of PA* (Adkins, Sherwood, Story, & Davis, 2004;Crawford et al.,2008; Dzewaltowski, Geller, Rosenkranz, & Karteroliotis, 2010; Dzewaltowski, Geller, Rosenkranz, & Karteroliotis, 2010; McKenzie et al., 2008b; Roemmich et al., 2006; Timperio et al., 2008; Trost et al., 2001; Ziviani et al., 2008) three studies *measuring the validity of a scale or tool* (Bryant et al., 2008; Huang, Wong, Salmon, & Hui, 2011; Sirard, Nelson, Pereira, & Lytle, 2008); *third party observational* (Farley et al.,2008); *children's perceptions of their environment* (DiLorenzo et al., 1998;Hume et al., 2005; Telford, Salmon, Timperio, & Crawford, 2005; Trost et al. 1997); and *children's self-reported PA with accelerometer measurements* (Corder et al., 2011; Pate, Trost, Felton, Ward, 1997; Roemmich, Epstein, Raja, & Yin, 2007; Trost, Pate, Ward, Saunders, & Riner, 1999).

Parental Perceptions of the Environment

With the exception of one parental perception study, Roemmich et al., (2006), theoretical framework was present in the reviewed studies. Roemmich et al., (2006) determined that the availability of facilities, including schools, associated with increased physical activity, any connection to a theory was not apparent. In another study, the importance of the child's environment was addressed through a parent survey instrument, these factors were addressed marginally (Crawford et al., 2008). McKenzie et al., 2008a, alluded to the "micro level" of SEM but did not operationalize the theory other than defining the "micro level" as the home environment. Observations during the study noted significant increases in PA when prompted by parents or other children while in the home environment. Ziviani et al., 2008, used census data to determine SES levels of neighborhoods in order to investigate the socio-environmental contributing factors; however the study did not utilize the SEM theory as a strong framework of the article. The study did highlight that students from lower SES engaged in PA mainly in their home environment or in their school environment, where the students with a higher SES added parks and public facilities not close to home.

Several studies had a range of theory definition to full utilization of a theoretical framework. Three studies used parental perceptions of the home and school environments through survey instruments, tying the environmental factors back to increased PA (Adkins et al., 2004; Loucaides et al., 2009; and Trost et al., , 2001). Adkins et al. (2004), and Trost et al. (2001), both mentioned Social Cognitive theory (SCT) and addressed parent modeling and peer interactions as factors in increased PA in

girls. Loucaides et al., (2009) referred to SEM as a factor in the increased PA of elementary aged students in Cyprus.

Measurement Development Home and School

A *Healthy Home Survey*, was developed and validated in a study through phone interviews and a survey instrument for parents. Evaluation of the home environment was the focus but no theoretical framework was present (Bryant et al., 2008). In contrast Huang et al., (2011), used SEM as a framework in the measure of validity and reliability of the environmental correlates of physical activity and screen based behaviors in elementary aged Chinese children. Family members and peers played a significant role in the PA behaviors within the home environment including modeling behaviors from parents, support of PA through developing the home environment and providing opportunities as well as encouragement from peers and family members.

Children's Perceptions and Self Reports

Lack of theoretical framework was evident in two studies in the children's self-reporting and perception. Measurement of PA in elementary aged students ranged from self-reporting through a survey instrument (Trost et al., 1997) to accelerator readings and child/ parent survey instrument (Telford et al., 2005) with no theory present and results that were similar, inactivity leads to increase weight gain. Increased sedentary behavior are associated with the home environments and the accessibility of television while increased PA is associated with neighboring facilities and it is these factors that contribute to the PA of children (Roemmich et al., 2007). The interactions of these factors were explained using the SEM model. Hume et al., (2005) explored

environmental factors important to children. In a unique study, children were given paper and asked to draw their home environments and some students were given cameras to document important areas in their lives. Using the SEM model, several themes were connected through different levels of the environmental factors. These themes included the shared or social space in their family home is important to children and provides feelings safety, warmth and security. It was also the home environment that provided PA opportunities for children not only indoors but outdoors in their yard.

Two children's perception studies received maximum scores for their theory utilization. Using SCT as the framework, Dzewaltowski et al., (2010), self-efficacy and proxy-efficacy was addressed. Students with higher self and proxy- efficacy had a higher SES and attended a school with lower concentration of racial/ethnic diversity. Veitch et al., (2006) operationalized the SEM framework and the individual factors as well as social and physical factors in relation to increased PA level in the home environment among elementary aged students.

Several themes emerged from the parent interviews. Social themes included safety and an absence of neighbors or nearby friends to play with influenced outdoor play. If children had large yards or lived on a court or cul-de-sac, this was not as much of an issue. However for 40% of the parents, it was. On an environmental level the themes were facility availability in parks and playgrounds, urban design factors and home environment. Within the home environment was the concern for the lack of opportunities for active free play due to space issues and equipment availability as well as children's level of independence. Availability of play spaces in and around the home

environment outdoors is important as time spent outdoors is one of the most consistent predictors of a child's PA (Sallis et al., 2000).

Theoretical Framework Quality of Reviewed Studies

All studies fitting the inclusion criteria were reviewed and a score of zero to three was assigned to each study based on the adopted instrument. Although this review did look at the factors and constructs utilized most frequently within the theoretical framework, a measurement of these factors and constructs was not assigned.

Fifty percent of the reviewed studies provided no evidence of a theoretical framework for their research. Fourteen percent showed some evidence of use of theory or constructs; nineteen percent inferred the use of a theory but never clearly identified one; and fourteen percent clearly identified and operationalized a theory within the study.

In their 2005 monograph written for the CDC, Rimer and Glanz suggest, "Theories and models help explain behavior, as well as suggest how to develop more effective ways to influence and change behavior". Theories in social sciences are always evolving because of the social context of behaviors (Rimer & Glanz 2005).

A theory is useful if it makes assumptions about a behavior, environment, or a target population. For a theory to be a good fit, these assumptions need to be logical; consistent with observations; similar to those used in previous successful programs and supported by past research (Rimer & Glanz 2005). A theoretical framework should be developed based on the elements of the research such as the problem, goal and units of practice and not because it is familiar or currently the "in" framework (Rimer & Glanz

2005). Multiple theories and models have been used to specify environmental variables that are believed to influence physical activity, Social Cognitive Theory and the Social Ecological Model being the most widely used.

Of the six studies scoring the maximum points for theory utilization, five studies used the Social Ecological Model (SEM) as the framework for the study, while the sixth used Social Cognitive Theory (SCT).

The traditional Social Ecological model asserts that there are many systems that influence an individual's developmental and behavioral outcomes. According to ecological theory, social systems are represented by nested systems on four levels of analysis: microsystem, mesosystem, exosystem, and macrosystem (Grzywacz & Marks, 2000). The SEM helps to understand factors affecting behavior. Individuals are influenced by and influence their environments. The unique interactions between individuals and their social, policy and physical environments are the ecological conceptual model used in the study of PA and children (Sallies et al., 1997).

SEM suggest that there are risk and protective factors in the microsystem, mesosystem, exosystem, and macrosystem for children and adolescents who face poor physical activity outcomes. The four levels are interrelated and may act as a system, with protective factors at one level of the system influencing outcomes at other levels.

The socio-ecological model (Bauman, Sallis, Dzewaltowski, & Owen, 2004; Stokols, 1992) stipulates that the interactions between the individual and their environment, including physical and social factors, results in health or health promoting

behaviors. The socio-ecological model provides a framework to understand the individual within their environment by emphasizing the interaction and integration of factors within and across the levels of influence (Bauman et al., 2004; Stokols, 1992). The model highlights the importance of addressing health issues at multiple levels and the interactions and integration of factors across levels. The model assumes that changes in the environment result in changes in the individual and those individuals as a group are essential for implementing environmental changes.

At an individual level, self-efficacy may be a factor of behavioral change, while the support and modeling behaviors of family members would affect change on the interpersonal level. Taking into account the environmental impact on PA, the SEM model distinguish themselves from earlier models by allowing for multi possibilities for promoting physical activity through different environmental influences.

Within the SEM is a construct in the multiple levels of influence (such as individual, interpersonal, organizational, community and public policy). In previous studies the SEM approach has been proposed (Grzywacz & Marks, 2000). The school environment is convenient and critical tool for promoting children's health interventions and provides the ability to observe the SEM approach.

A similarity between SEM and SCT is *reciprocal determinism*, in which a person's behavior is influenced and influences the social environments. A person can be a "change agent" or and "agent for change", depending on the situation (Rimer & Glanz, 2005).

In his conceptual model of SCT, Bandura (1986) illustrated the three foundations of SCT: Personal Factors, Environmental Factors, and Behavioral Factors. Social Cognitive Theory is one of the most predominant theoretical approaches in health research involving physical activity. While the social ecological model is used in numerous studies, SCT is a theory that complements the SEM. SCT suggests that the continuous interaction between individuals and their environment affects behavior. It is through this interaction that people not only learn through their own experiences but when observing the actions of others. A strength of SCT is that it recognizes that the individual's behavior can be shaped by the environment, it also focuses on the individual's preferences and the potential to alter and construct their environments (McAlister et al., 2008). SCT also focuses on a person's self-efficacy, the confidence in their ability to attempt obstacles and challenges.

SCT shares similarities with SEM in the emphasis of environmental influences on an individual's behavior. Such influences can include modeling of behavior, physical environment, and socially accepted practices. In relation to physical activity, access and availability of programs, facilities and equipment are environmental elements. In the school and home environments are the two predominant environments for children. The other two components of SCT are personal and behavioral factors (McAlister et al.,2008). Personal factors or cognitive factors are used interchangeably throughout the literature but include an individual's knowledge, beliefs and attitudes. Behavioral factors are directly related to the actual performance of a behavior and would include factors such as intention and skills (Motl et al., 2002).

Within the review several constructs in the home and school environment were common throughout multiple studies. Self-efficacy was stronger in girls than boys as was reported in a previous study (Trost et al. 1997) as well as gender during recess (girls less active than the boys). A number of studies alluded to the impact of role models in the home and the lack of physical activity by the home parent. In one study, Adkins et al., 2004, mothers reported being involved in physical activity with their children but upon further review, the mothers were not sharing in physical activities with their children, but rather providing transportation and financial support of their children's physical activities.

It is important to understand these factors in order to provide interventions in the home and school environments as well as advance the field of study. With these factors in mind, development of interventions that are comprehensive and wide reaching and focus on the whole environment and not just pieces. As a society we are quick to try and change the individual instead of looking at the whole picture and interventions that are not developed holistically may not achieve the intended results. Children are reliant on society for direction and opportunity. Interventions that fall solely within the child fall short.

DISCUSSION

This review has provided an overview of current body of literature focusing on two environments: the home and school, and their relationship with children's PA. The review covered all studies completed from January 1980 to March 2012. Originally starting with over 5300 articles, only forty-two met the inclusion criteria and of those

only 14% (6) clearly identified and/ or operationalized the theory or model driving the study.

It would appear that few studies are being guided by a theoretical framework or model and this suggests that any understanding of the home and school environment in relation to PA in children may be limited. Seventy-five percent of the studies using theory to guide their study, used social-ecological for their framework, while the other twenty-five percent applied Social cognitive theory. The two theories have many similarities and strengths, however SEM seems more user friendly and easier to apply. Ideally, a combination of both would provide an amazing framework for a study.

Given the recognized importance of the home and school environments of children and the relationship to physical activity, the absence of theory-driven research is surprising. If studies have drawn on well-defined and accepted environmental theories for study design, there is a lack of operationalizing them in the literature. The reader should not have to try and decipher the theoretical framework of a study based on the constructs measured; researchers should highlight and outline the theories used to develop the study. If research is rooted in a strong theoretical framework and is paired with a conceptual model, results from the study can be applied to larger populations. The area of physical activity or physical inactivity in children is a complex issues involving multiple factors. It is for that reason alone that researchers must develop studies incorporating these multiple factors with a framework or model. Results form studies provide the foundations for interventions. It is important that these foundations are strong and are used in the development and evaluation of behavior interventions. With

so few studies using a theoretical framework, how developed is our body of knowledge? How solid are our interventions or evaluations? Research on play and leisure is sometime dismissed as being "not science" and "fun", researchers support this by developing studies and conducting research without an applied theory or conceptual model.

Additionally, the area of environmental measurement should be addressed from the viewpoint of children and not mainly parental perceptions. SEM is based on multiple levels of environments that influence an individual and SCT acknowledges that their environment can influence an individual's behavior; each of these levels should be addressed. With the SEM framework we can identify and investigate potential correlates of physical activity in children. Measuring the physical, social, and individual factors and how they interact to support or constrain children's physical activity. Throughout the reported studies all of these factors have been identified and the multi-domains should be explored to provide a comprehensive measurement of physical activity.

Over 70% of the studies used parental questionnaires as measures of environment, availability of resources, and physical activity measurement. Earlier studies on physical activity have shown that 60 % of the adults overestimated their own physical activity level (Ronda, Van Assema, & Brug, 2001).

Self-reporting may be unreliable, especially by children, and it provides less accurate information on physical activity behavior than objective measures of physical activity (Welk et al., 2000). A combination of environmental factors and physical

activity would produce the most comprehensive measurement and cover the different environmental influences.

Through this review, several family variables emerged including perception of family and friends (Trost et al., 2001), restrictions of indoor and outdoor play (Bryant et al., 2008;Corder et al., 2011;Trost et al., 1997), availability of equipment (Felton et al., 2002;Roemmich et al., 2007;Trost et al., 2001), and self-efficacy (Dzewaltowski et al., 2010; Hume et al., 2005; Loucaides, Chedzoy, Neville Bennett, & Walshe, 2004).

Throughout the studies included in this review, common methodological problems were identified. Frequently small sample sizes were an issue as demonstrated in the 69% of reviewed studies with less than 300 participants and of those, 24% had less than 100 participants. As discussed previously, a strong theoretical framework will provide a strong foundation allowing for generalizations over a population. Without the framework or model, the information obtained from the study may lack substance and weight. Environmental variables may be measured either using objective or subjective (self-report) measures and in ways that may differ from other similar studies. This variation in measurement methods and variable definitions makes it difficult to summarize and compare between and across the growing literature base. Measures of the outcome variable physical activity also differ, and where this is assessed using self-report measures the responses may be unreliable, particularly among children.

Limitations

A limitation of this review would be the specific population, children ages 5-12 years, which was a main exclusion criterion. If the review had included studies

involving youth and adolescents 5-18 years of age, the results would have tripled. The decision to focus on this specific age was intentionally chosen to highlight a gap in the current literature. It has been documented that children have an abundance of energy and physical activity which starts to decline after sixth grade (approximately age 12) and then again in adolescents prior to adulthood.

CHAPTER III

MANUSCRIPT 2: EXERCISE, SPORT AND ATHLETIC EQUIPMENT (ESAE) IN THE HOME AND SCHOOL ENVIRONMENT: A SYSTEMATIC LITERATURE REVIEW

It is a hot summer day and the neighborhood kids are playing in the cul-de-sac in front of their houses. Johnny owns the big red ball and the group is involved in a serious game of four-square. Suzy is in the King's square and makes the "cherry bomb" rule enabling all players to hit a sky-high ball over another player's head, seeing an opportunity to advance to the next square, Jack chooses to "cherry bomb" Johnny. All four square players know that the "cherry bomb" is one of the tougher ball returns of the game, and as Johnny gives a valiant return effort, he is hit in the face. The force of the ball causes his nose to bleed and with a "huff" he grabs his big red ball and proceeds home. The loss of the ball has ended the game due to unavailability, but unavailability of what? Is Johnny's big red ball just that, a ball? Or is it a piece of playground equipment? Or is it just a piece of equipment? What about physical activity equipment, play equipment, portable equipment, recess equipment, game equipment, and my favorite, "Manipulative play equipment?" Confused yet? Well you are not alone because the literature refers to the big red ball as all of those terms in one study or another.

INTRODUCTION

Physical activity (PA) during childhood is important for development, growth, and health. Physical activity contributes to the energy balance equation or energy use.

Most Americans are reported to have insufficient physical activity as defined by the CDC (2010). In order to enhance quality of life and promote health, CDC guidelines suggest that children should engage in 60 min of daily moderate-to-vigorous physical activity (MVPA) There is growing concern, however, that children do not engage in enough PA to promote health. A study by Riddoch et al. (2007) found that adolescents14 to 16 year-old were less physically active than their 11- to 13-year-old counterparts and that many children were active for less than 1 hr. a day.

For children under the age of twelve, the home environment has been suggested as a critical environment for opportunities of PA. Obesogenic (or obesity promoting) environments are described in an ecological framework in terms of macro and micro environments in which individuals have more or less control (Grzywacz & Marks 2000; Swinburn, Egger, & Raza, 1999). Macro-environment describes the culture in which individuals live. This can include ethnicity, SES, poverty or development of the country. Included in the macro-environment would be the child, the family, and the school. The family home, the school and the neighborhood are micro-environments for children. Characteristics of these micro-environments are direct determinants of children's PA behaviors.

Another appropriate setting for PA promotion in children is the school environment (Wechsler, Devereauz, Davis, & Collins, 2000). There are several opportunities throughout the school day for PA interventions, including physical education, recess and before and after school programs. Documentation on the effectiveness of physical education interventions is evident in a 1997 study by Sallis et

al., and the evaluation of the SPARK program. Perceived and actual equipment availability are factors in the home and school environments of children. Studies using environmental models as the framework for physical activity in children include the home and school environments (Roemmich et al., 2007;Sallies et al.,2006; Sallis et al., 2000; Trost et al., 2001). The use of environmental models in health related research is becoming a standard. Multiple reasons for the use of these models include the influence of hard to reach populations such as lower income, lower education and groups affected by language barriers (Galbally, 1997). Use of environmental changes may be cost-effective because they can be incorporated through the different levels of the SEM model including public policy, community, organizational, interpersonal and individual (Swinberg et al., 1999) . However the longitudinal impact of recess based interventions on PA in children has very little data associated (Ridgers et al., 2010b)

"Equipment" plays a role is the fight against childhood obesity, but to what extent is still unknown. There is a growing body of literature that has continued to expand the foundational work of Sallis et al., (1997) and the development of the Physical Activity Environment and Home Equipment scale. The Home Equipment scale was moderately correlated with frequency in both vigorous and strength exercises (Sallis et al.,1997). As one of the earliest acknowledgments of the importance of equipment, it is an instrument with validity and is currently used in several studies (Ding, Sallis, Kerr, Lee, & Rosenberg, 2011;Durant et al., 2009; Sallis et al., 2000).

In the home and school environment of many children availability and usage of equipment is the key to increasing PA. The purpose of this systematic review is to

gather, assess and evaluate the studies examining the relationship of equipment availability and PA behaviors in children, ages 5-12, in relation to their home and/or school environment(s). This review will focus on studies that acknowledge equipment availability as a factor in increased PA in children. After these studies are identified a review of each article for the definition of equipment is addressed in the study, how is it defined if at all?

The review aimed to address the following specific research questions:

(i) Is equipment identified and operationalized as an environmental variable of children's PA in the home/school environment.
(ii) If equipment is identified in the study, how is it defined?

METHODS

Search Procedures

The review sought to identify all studies that examined the relationship between home and/or school environments and a relationship with equipment and specific outcome of PA behavior in children (age5-12). Cross-sectional, experimental results and longitudinal studies were included. Dissertations, qualitative studies, and expert opinions were excluded.

Studies were included only if there was a specific measure of equipment in relation to PA in children ages 5-12. Eligible references to equipment could indoor or outdoor equipment, loose or permanent equipment, equipment associated with the home of school environments. An electronic search was undertaken to identify studies reporting equipment availability as a factor in increased PA in children. Studies were located from multiple sources. The review was limited to papers published in the English

language as well as published between the time period from January 1980 to March 2012.

Searches were conducted in Sport DISCUS and four other electronic databases (Academic Search Premier, ERIC, Science Direct, and Physical Education Index). A manual search of reference lists; key journals established through electronic database searches and individual authors personal files was conducted.

Search terms included, *physical activity, youth, children, child, school, home environment, equipment, playground, play equipment, recess, parents, sport, exercise, free play, play, perceived environment and family.* The truncation symbol was used in the search to ensure all terms were identified. The search was validated by an experienced research librarian. After potential articles were reviewed through titles and abstracts, full text copies of the articles fitting the selection criteria were retrieved.

Inclusion/Exclusion Criteria

Studies that met the inclusion/exclusion criteria, illustrated in Table 3, were kept for review. Studies were excluded if they were not research articles; were focused on "built environment" of school; focused on environments other that home or school; if the population was older or younger then elementary age children (5-12 years) ; and if the focus was on structured/organized PA (i.e. Physical Education class or before and after school programs).

Table 3: Inclusion criteria for systematic literature review on physical activity and equipment

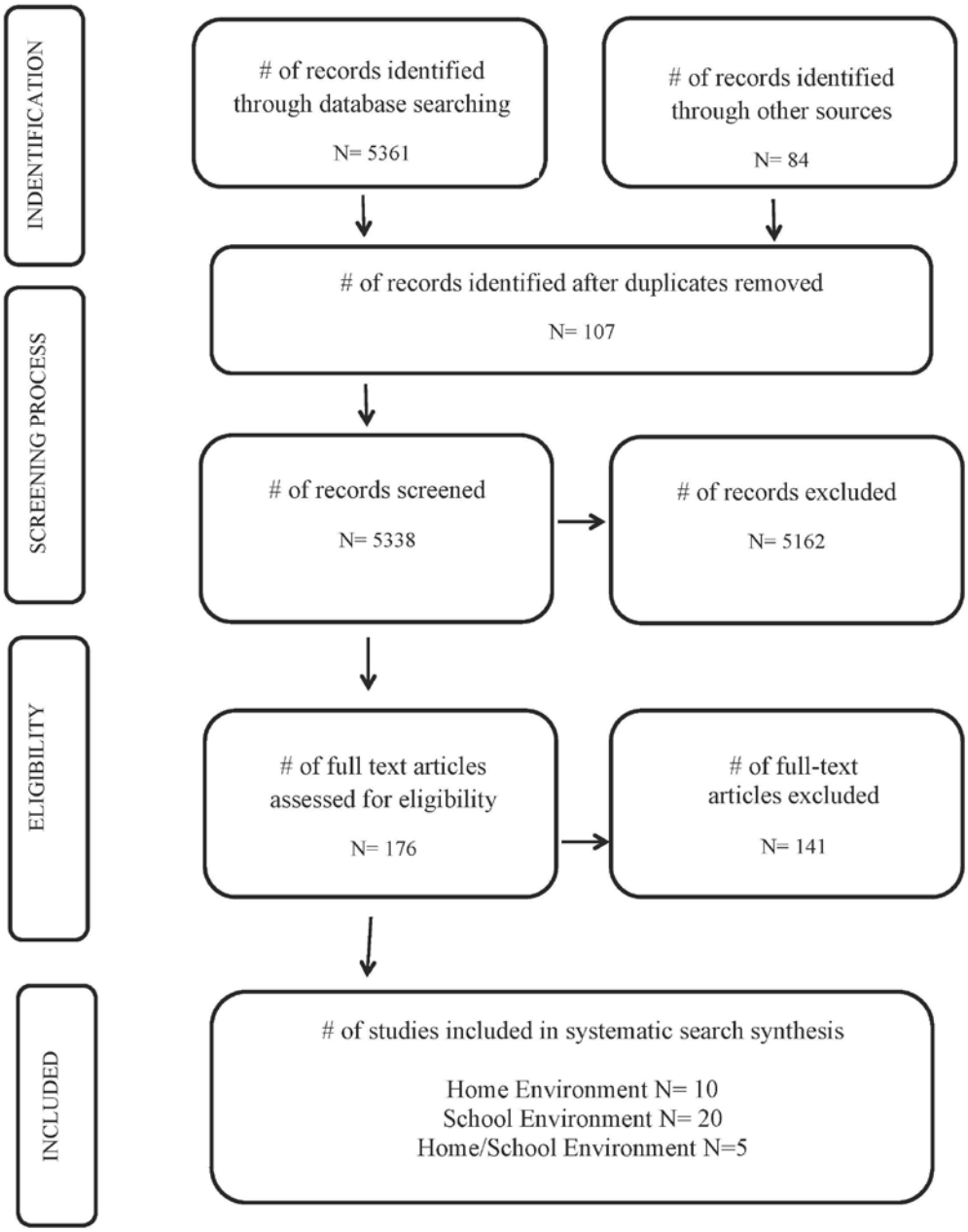
Criteria	Study included if:
Study focus	(a) Used clear measure of Physical Activity (PA)
	(b) Target elementary aged children (5-12 years of age) and /or their parents
	(c) Focus primarily on home and school environments
	(d) Mentioned "equipment" as a factor of PA
	(e) Study occurred in a developed country
	(f) Appeared in an English language peer-reviewed journal

RESULTS

The preliminary search of electronic databases (5361 potential relevant articles), reference lists and author personal files identified (84 potential relevant articles) (Figure 2). Elimination of duplicates with EndNote X5 (Thomson Reuters) a reference manager software and any remaining duplicates were removed manually resulted in 107 studies removed. Screening of titles and abstracts resulted in 176 articles for full text review using the previous stated inclusion/ exclusion criteria. After reviewing full-text of these studies, 20 studies met the inclusion criteria, six which related to the home environment, thirteen relating to the school environment and one study that addressed equipment in both environments.

Figure 2 depicts the selection process for the search. All articles were given an identification number in the database prior to review. For each study, the following were recorded: (a) first author and year published; (b) study design; (c) Methods used in

Figure 2: Exclusion/ Inclusion process study 2



study; (d) Population involved; (e) Number of participants (N); (f) Equipment identified; and (g) Equipment definition score. The information was recorded by the author and cross checked to identify any issues.

Multiple exclusion of full text articles occurred due to population age of sample; study did not address equipment as a factor; study was a duplicate of a previous study and several studies had multiple criteria excluded, (Figure 2).

Once the 20 studies were identified, a matrix was completed (Table 4), with information from each article summarized including the study characteristics including author; study design; location; population description and number; Equipment identified; and the Equipment definition score. Findings from the studies were reviewed and each article was scored for Equipment identification and operationalization. In order to evaluate the definition of Equipment, the author used an instrument adapted from Delissaint and McKyer (Delissaint & McKyer, 2008). See Table 5.

Table 4: Summary table of results showing definitions and scoring of Exercise, Sports and Athletic Equipment (ESAE)

Reference	Study type	Setting	Population	# of participants	Environment	PA measurement	ESAE defined	ESAE Score
Anthamatten et al. (2011)	CS	USA	6-11 yr.	3688	S	OB	Play Structure	1
Beighle et al. (2006)	CS	USA	3rd-5th grade	270	S	M	Footballs, playground balls, soccer balls and jump ropes	3
Bryant et al. (2008)	I	USA	3-8 yr.	85	S	M	Mentioned as "play equipment in the yard, bike/riding toy	2
Corder et al. (2011)	CS	USA	5-8 yr.	541	H S	M PP	PA equipment, Scale of 0-8 of number of items defined as play equipment-includes swings, slides, climbing or ladders. Also asked about tricycle, bike, scooter or wheeled toy	3
Crawford et al. (2008)	CS	AUS	K-6th grade	175	S	PP SR	"Good quality outdoor equipment"	1
DiLorenzo et al. (1998)	L	USA	5th-6th grade	111	H	PP SR	Mentioned not defined	0
Erwin et al. (2012)	CS	USA	3rd-5th grade	160	S	M OB	playground equipment/includes jump ropes, bouncy balls, badminton rackets	2
Farley et al. (2008)	CS	USA	K-8th grade	1063	S	OB	footballs, basketballs, playground balls, hula hoops, jump ropes, parachutes and flying disks.	3
Haug et al. (2010)	CS	NOR	K-6th grade	9613	S	SR	Playground equipment	1

Table 4: con't

Reference	Study type	Setting	Population	# of participants	Environment	PA measurement	ESAE defined	ESAE Score
Howe et al. (2011)	CS	USA	3rd grade	45	S	M OB	Mentioned not defined	0
Huang et al. (2011)	CS	CHI	9-14 yr.	303	H	PP	Home PA equipment	1
Huberty et al. (2011)	CS	USA	3rd-5th grade	93	S	M	Mentioned not defined	0
Hume et al. (2005)	CS	AUS	10 yr. olds	147	H S	SR	bicycle, pool, trampoline, and basketball hoop by kids/equipment	3
Jones et al. (2010)	I	UK	9-10 yr.	2064	S	M	outdoor play equipment fixed , and sports equipment goals and balls	3
Lopes et al. (2009)	CS	Portugal	6-12 yr.	158	S	M	Outdoor play equipment and included balls, skipping rope, paintings on floor	3
Lousaides et al. (2004)	CS	Cyprus	6th grade	256	H S	PP SR	Mentioned not defined	0
Lousaides et al. (2009)	I	Cyprus	5th-6th grade	247	S	M	play equipment-jump ropes and balls	1
Nielson et al. (2012)	CS	Denmark	6 and 10 yr.	704	S	M OB	play facilities-soccer goal, b-ball goals, loose equipment	2
Pate et al. (1997)	CS	USA	5th grade	558	H S	SR	Mentioned not defined	0
Ridgers et al. (2007)	L	UK	K-5th grade	470	S	M OB	sports equipment-soccer balls, tennis balls, jump ropes	1
Ridgers et al. (2010)	I	UK	K-5th grade	256	S	M	manipulative playground equipment-soccer balls, jump ropes and tennis	2

Table 4: con't

Reference	Study type	Setting	Population	# of participants	Environment	PA measurement	ESAE defined	ESAE Score
Ridgers et al. (2010)	CS	UK	9-10 yr.	152	S	M OB	Portable equipment- Includes bats, balls, jump rope.	2
Ridgers et al. (2011)	CS	UK	3rd-6th grade	257	S	M	Mentioned not defined	0
Saint-Maurice et al. (2011)	MM	USA	3rd-5th grade	100	S	M OB	Mentioned not defined	0
Sirard et al. (2008)	I	USA	Families	10	H	SR	Development of a 50 item list	3
Stucky-Rupp et al. (1993)	Q	USA	5th-6th grade	242	H	PP SR	Mentioned not defined	0
Taylor et al. (2011)	CS	New Z	K-5th grade	473	H S	M	"Play equipment"- referred to permanent play structures	2
Telford et al. (2011)	CS	USA	5-6 / 10-12 yr.	291/919	H	M PP	Not defined but multiple pieces of "ESAE " were listed	1
Timperio et al. (2008)	CS	AUS	10-12 yr.	919	H	M PP	Physical Activity Equipment- balls bats, rackets, bikes ,home gym, skateboards ,skipping rope ,rollerblades	2
Trost et al. (1997)	CS	USA	5th grade	229	H	SR	sports and fitness equipment/	1
Trost et al. (1999)	CS	USA	6th grade	119	H	M	Mentioned not defined	0
Trost et al. (2001)	CS	USA	6th grade	213	H	M SR	Mentioned not defined	0

Table 4: con't

Reference	Study type	Setting	Population	# of participants	Environment	PA measurement	ESAE defined	ESAE Score
Veitch et al. (2006)	CS	AUS	1st-6th grade	78	H	PP	Play equipment mentioned but defined as Playground structures.	1
Verstraete et al. (2006)	CS	Belgium	5th-6th grade	235	S	M OB	Game Equipment jump ropes, double Dutch ropes, scoop sets, flying discs, catch balls, polo ball, plastic ball, plastic hoops, super grips, juggling scarves, rings, bean balls, diablo, angel stick, spinning plates, sets of badminton racquets and sets of oversized beach paddles	1
Zask et al. (2001)	CS	AUS	K-6th grade	3912	S	OB	Balls	1

Abbreviations: CS= Cross-sectional, H= Home, I= Intervention, L= Longitudinal, M= Measured, MM= Mixed-methods, OB= Observational, PP= Parental perception, Q= Qualitative, S= School, SR= Self-reported

Table 5: Criteria for assessing studies' identification and operationalization of equipment

Criteria	Description	Score
Equipment defined	Clear identification/operationalization Equipment	3
	Use of definition of Equipment (not clearly identified)	2
	Some evidence of Equipment definition	1
	No evidence of definition of Equipment in research	0

Adapted from Delissaint and McKyer (2008)

Equipment in School Environments

Sixteen studies specifically looked at the school environment with definitions and/or identification of "equipment" running one end of the scale to the other. Of the studies included in the review associated with school environment, 15, two articles did not identify nor define equipment as part of their study (Saint-Maurice et al., 2011; Veitch et al., 2006). Of the school studies that scored the maximum, equipment was defined as footballs, basketballs, playground balls, hula hoops , flying disks and jump ropes (Farley et al ., 2008); as well as being defined as "jump ropes and balls" (Beighle et al., 2006; Loucaides et al., 2009); and "game equipment"(Verstraete et al., 2006). Throughout this review several themes or groups emerged for discussion on types of equipment used in the home and school environment; loose equipment and play structures. Throughout the studies, equipment was rarely defined. A common theme in "defining" equipment was to write the word "equipment", followed by examples of what types if equipment was used. Not all equipment was addressed throughout the article, which makes it difficult to compare one study to another.

Loose Equipment

Loose equipment can be identified as several pieces of equipment that are used during recess or in off-hour school time and are portable. It is the equipment that is carried out and returned when children are through playing with it. It can be defined as balls (sport balls such as baseball, basketball, soccer, and football or the playground ball), bats, jump ropes, hula hoops, and Frisbees, your typical playground/recess equipment. Studies assessed the use of loose equipment and its relationship to increased PA and MVPA during recess on the school playgrounds. In one study, children were provided with the use of pedometers to track steps during recess were measured reporting that a significant amount of daily PA was achieved during recess (Beighle et al., 2006). Use of loose equipment was generally used by boys in open areas for football and soccer while the girls choose to be less active and more social which is consistent with the literature on recess and gender. One interesting highlight was a game of "wall ball" a form of handball that occupied two girls at a time with a waiting line of at least ten at a time (Beighle et al., 2006). Two studies in Cyprus, identified equipment as an important aspect of the recess play time and important in the increase of PA; however equipment was only defined in one study (Loucaides et al., 2004; Loucaides et al., 2009) In the 2009 study, Loucaides identified equipment as "playground equipment" which then identified balls and jump ropes.

In three studies (Ridgers et al., 2010a; Ridgers et al., 2007b; Verstraete et al., 2006) the concept of loose equipment was used. Multiple pieces were listed under different names. In the first article, equipment was mentioned and included balls, bats and jump ropes as well as juggling scarves, rings and bean bags, badminton sets, beach

paddles, oversized racquets and a diablo angel-stick (Verstraete et al., 2006). In two different articles written in the same year by the same author identified equipment as "manipulative playground equipment" which included soccer balls, jump ropes and tennis balls (Ridgers et al., 2010a) as well as "portable equipment", such as balls, bats, and jump ropes (Ridgers et al., 2007a). All three studies used a different label but all pieces of equipment listed fell into the "Loose Equipment" category. In all three studies, measurements of MVPA were shown to increase with the availability and use of this equipment.

Another label, "Playground equipment", which included jump ropes, bouncy balls and badminton racquets, was used to define the availability of equipment during recess that was positively associated with increased MVPA during fifteen minute intervals of recess (Erwin et al., 2012). Measurement of PA was measured pedometers and the amount of steps associated in that recess time period. Girls had less MVPA during these measured sessions however they increased the amount of MVPA when equipment was introduced.

Farely et al. (2008), combined the availability of loose equipment, (as defined in the study as balls, jump ropes, Frisbees and hula hoops) with installed play equipment (defined as monkey bars, playground set, basketball net for example) and found that children were drawn to the installed equipment when available and their second choice was an open play area where they could make use of the loose equipment (Farley et al., 2008) These open play areas were either a large field where games of soccer of football were played or an open area of playground spaces were jumping and ball games were the activities of choice. Very few girls participated in PA in the open fields area, however

they did jump rope and play basketball on the pavement as well as use the play structures when available.

Play Structures

A second theme emerging from the review of school studies was the use of multiple words to describe play structures. Play structures are permanent pieces that are purchased and installed in the playground area such as a set of swings, basketball hoops, soccer goals, climbing structure or slides. This does not count playground markings for game boundaries such as hopscotch, basketball or four-square. Four studies used the term "play equipment" to describe a built or permanent play structure that was a part of the playground.

Studies used different measurements of PA such as pedometers, accelerometers, and observation methods to draw associations between increased PA and MVPA and the activities that the students were involved. Students wore the pedometer or accelerometer while playing during recess and trained staff observed when children played and how many children played in an area. Taylor et al., 2011 found that the association between increased PA and the number of play structures was significant. Using accelerometer readings over a five day period, boys were significantly more active than girls ($P<0.001$); however the amount of time spent in MVPA minimal, boys (17 minutes) and girls (10 minutes) per school day.

Using the System for Observing Play and Leisure Activity (SOPLAY), a method for evaluating the levels of PA, school playgrounds were divided into different play areas for observation (Anthamatten et al., 2011). The school playgrounds also underwent an overhaul of the "schoolyard equipment". "Schoolyard equipment" in this study falls

under the play structure theme. A Denver based playground company installed new play structures on several playgrounds in local Denver schools. They replaced pieces of play structures, repaired and repainted others. They also painted several game lines on the pavement and created welcoming archways. Measurements of MVPA increased on all playgrounds after the install; however in a six month follow-up, PA levels had decreased leaving the researchers to wonder if it was the novelty of the new equipment. What did increase and stayed consistent was the amount of MVPA in boys, and girls had no increase in MVPA after install but stayed consistent through the six month period.

In the last study that addressed play structures, also had a component of loose equipment also (Farley et al., 2008). Another study using SOPLAY as its measurement of PA during recess found that play structures had the greatest number of children playing at one time, however not necessarily generating MVPA minutes. The play structures were not changed in anyway but continued to be the favorite area. The second areas that attracted numerous children were areas that were "equipped". Each observation day, Loose equipment consisting of 5-10 footballs, 10-12 basketballs, and at least 20 each of playground balls, hula hoops, jump ropes, and flying discs, were distributed to different open areas. On some days, four parachutes were also added. After 46 weekdays and 16 weekend days of observation, play structures and "equipped areas" attracted the majority of boys and girls daily. Children were also coded as having higher levels of MVPA in these areas.

Mentioned but not Defined

In the remainder of school studies, equipment was mentioned and in several studies and was found to be a significant factor in increased PA in children. In these

studies the word “equipment” is used with no reference to what they are including as equipment. A British study mentioned “equipment” usage was associated with increased MVPA in fifth and sixth graders during recess but did not discuss “equipment” so readers are unable to compare the findings to other studies (Telford et al., 2005). Another study in which “equipment” contributed to an increase in MVPA, used the SOPLAY system of observation as the measurement of PA. Boys were more active than girls during recess and there was an overall 30% increase in MVPA when settings were “supervised and equipped” (Saint Maurice et al., 2011). No significant association with increased MVPA in elementary students was found in a study of Norwegian students using “equipment” as a factor (Haug et al., 2010). Again no reference in the study allowed readers to compare findings across studies.

Home Environment

Six studies focusing on the home environment, consisted of one study achieving the maximum score (Corder et al., 2011). The study examined frequency of use of eleven PA locations amoung 350 San Diego children. Equipment was addressed as “ Home PA equipment”. Parents completed a questionare and “Home PA equipment” was operationalized as an eight item list that was adapted from a validated instrument (Rosenberg et al., 2010). Parents were to provide a ranking from “0-8” on the number of items which included, swings, slides, ladder or climbing ropes, tricycle, bicycle, scooter or wheeled toy. Eighty-nine percent of the parents felt it was within their means to increase the PA opportuinities for the children including usage of equipment.

An association between an increase in PA and equipment was significant with a small variance in the R^2 (.15) in a study (Hume et al., 2005). Children were asked to

draw maps of locations that they participated in physical activity. Fifty participants were also given cameras to document their environments in more detail. The participants were given very few parameters about what they could include. Back yards, front yards, cul-de-sacs and schools were the top places depicted by the children. When analyzing the drawings and photos, permanent play structures were noted as "play equipment" while other pieces of loose equipment (e.g. : balls and jump ropes) were mentioned as equipment. The play structures included slide, swing, climbing elements, basketball hoops and soccer goals at the school environment and basketball hoops, trampolines, and pools in the home environment.

Measurement Development Home and School

The two of the last three home environment studies mentioned equipment; however neither studies provided a conceptual definition (Bryant et al., 2007; Huang et al., 2011). Bryant et al., (2007), included "play equipment in yard" and "bike or riding toy" in the survey instrument as items that could be checked as availabile and in a Chineese study, Huang et al., (2011),adapted question from Sallis' "Active Where? Scale" (Sallis et al., 1997). In the discussion of the findings, equipment was included as a part of the home physical enviroment which was significant in increased PA in chineese students. The only piece of "equipment" mentioned in the discussion,were sports clothes.

In a 2008 study, Sirard and colleagues established the validity and reliability of a home inventory for physical activity and media equipment, Physical Activity and Media Inventory (PAMI). The instrument is unique in the fact that fifty items of equipment commonly found in the home environment are included (Sirard et al., 2008). This list is

also unique in the fact that not only recreational items are listed but also pieces of yard equipment such as a snow shovel, that would allow you to create episodes of physical activity while doing household chores. There are six different categories of equipment (Sports equipment, fitness equipment, transportation equipment, water sports equipment, and outdoor/yard equipment) and one category of media equipment.

Equipment as Defined in the Literature

Based on the systematic review there is no standard definition of "equipment" in the literature. "Equipment" ranges from the simple red playground ball to an outdoor play structure. Studies did not address the variable "equipment" by defining it, instead, authors would generally write the word "equipment" and if they identified it past the generalized term it was in the form of examples. From their study, Ridgers et al. 2007a, identified equipment like this, *"Small pieces of sports equipment such as skipping ropes and soccer balls were available for use in all school playgrounds throughout the study",* while Adkins et al. (2004) identified it as, *"Girls who reported having access to a safe place to play or equipment necessary to play a sport were more active"*.

The majority, (77%), of studies reviewed stated that equipment availability and/or usage was significantly associated with increased PA in children. Comparing results from similar studies would be helpful, however almost impossible due to the non-standardization in the current literature. In the reviewed studies, three themes of equipment emerged: loose equipment, play structures, and home equipment. The author defined and categorized these themes based on the literature. The term "loose equipment" describes equipment that is portable. Small individual pieces of equipment

that children or parents can carry themselves such as a ball, bat, or jump rope etc. and are usually available and in the school and home environment. Play structures are far more permanent in nature, not easily transported and once installed would be difficult to remove. This theme could include but not limited to swings, basketball hoops, or a climbing apparatus. For the last theme home environment, equipment included here could be a pool, trampoline, personal sports equipment or other items associated with the home environment. The variable, "equipment" is also identified 14 other ways in the literature. As part of this review, individual pieces of equipment addressed in the studies as well as generalized equipment descriptors were listed in a table format (Table 6). Reviewing the table you can start to understand the difficulty of comparing studies when "equipment" has no standardization in the literature. Items in the "Equipment" column, Table 6, are pieces of equipment mentioned specifically in review, (e.g.: soccer ball, jump rope, badminton rackets), in the "how defined in the literature" column, are other ways that same piece of equipment is referred in the literature.

Table 6: Equipment in the literature

Piece of Equipment	How identified in the literature
Aerobic Equipment	Home PA Equipment Physical Activity Equipment
Badminton Rackets	Game Equipment Playground Equipment
Baseball back stops	Fixed Playground Equipment Play Facility School PA Equipment
Basketball Hoops	Basketball Goal Basketball Nets Basketball Ring Equipment Fixed Equipment Fixed Play Equipment Play Facility Playground Equipment Sports Equipment School PA equipment
Basketballs	Balls Loose Equipment Physical Activity Equipment Playground Equipment Sports Equipment
Bats	Loose Equipment Physical Activity Equipment Portable Equipment Sport Equipment
Beanbags	Game Equipment Playground Equipment
Bike	Physical Activity Equipment Riding Toy

Table 6 con't

Piece of Equipment	How identified in the literature
Climbing Frames	Fixed Equipment Playground Structure
Equipment*	Exercise Equipment Exercise or Fitness Items Fitness Equipment Game Equipment Home Equipment Home Exercise Equipment Loose Equipment Physical Activity Equipment Play Equipment Playground Equipment Portable Equipment Recreational Equipment Sports Equipment Sport and Home Fitness Equipment Toys
Football	Balls Loose Equipment Physical Activity Equipment
Frisbees	Loose Equipment Physical Activity Equipment Plastic Disks
Home gym Equipment	Fitness Equipment Physical Activity Equipment
Indoor exercise machines	School PA equipment Workout Equipment
Jump Ropes	Double Dutch ropes Equipment Game Equipment Loose equipment Long Ropes Physical Activity Equipment

*Instead of using "equipment" these other words were used.

Table 6 con't

Piece of equipment	How identified in the literature
Jump Ropes con't	Play Equipment Playground Equipment Portable Equipment Rope Short Ropes Skipping Rope Sports Equipment
Plastic hoops	Game Equipment Hula Hoops Portable Equipment Sports equipment
Play structures	Fixed Play Equipment Jungle gym Permanent Structures Physical Activity Equipment Playground Equipment Play Facility Play Structure Swings
Playground balls	Balls Equipment Game equipment Loose Equipment Physical Activity Equipment Play Equipment Playground Equipment Portable Equipment Sports Equipment Tennis balls
Physical Activity Equipment	Exercise, play , recreation room Roller Skates/Roller Blades Sport Equipment Stairs Swimming Pool Toys that encourage active play Trampoline Water/Snow Equipment Yoga/Exercise Mat

For example, *"**Equipment** includes 5-10 **footballs**, 10-12 **basketballs**, and at least 20 each of **playground balls**, **hula hoops**, **jump ropes**, and **flying discs**"* (Farley et al., 2008). Some of those same pieces of equipment are addressed by a different group name like, "*There are 20-30 pieces of **playground equipment** such as **footballs, playground balls, soccer balls, and jump ropes***"(Beighle et al., 2006).

Something that is amazing is the different ways "jump rope" is described throughout the studies: Equipment, physical activity equipment, playground equipment, game equipment, sports equipment, long ropes, short ropes, play equipment, portable equipment, loose equipment , game equipment, double-dutch ropes, skipping rope, and rope.

Recommendation for Future Studies

There are several gaps in the literature that need to be addressed in future studies, specifically the lack of a standardized process of identifying equipment in the home and school environments. Equipment has the potential to be a critical factor in promoting physical activity in children. Several studies have been conducted to test the validity and reliability of an instrument to measure factors that increase PA. With the exception of the PAMI, these instruments have not been very comprehensive in nature. Using the PAMI as a guide, the author has made some adaptations that allow for the new instrument to measure the home and school environments and give researchers a synopsis (Table 7). With eight categories and 52 items, common pieces of equipment have been grouped together to allow for a complete overview of equipment availability. As in the PAMI, individuals will go through the checklist and not only indicate that the

Table 7: PA equipment in the home and school environments

#	Fitness Equipment
1	Aerobic workout videos/DVDs
2	Exercise / Pilates/ yoga mat
3	Fitness ball
4	Indoor trampoline
5	Stationary exercise equipment (treadmill, bike, step/slide aerobic)
6	Weight lifting / resistance training equipment

#	Loose/Portable Play Equipment
7	Balls (soccer, football, basketball, playground ect.)
8	Bean bags
9	Frisbee
10	Hula Hoops
11	Jump Rope
12	Parachute
13	Plastic Cones
14	Toys that encourage active play

#	Outdoor /Yard Equipment
15	Net (volleyball, badminton
16	Pool (in ground or above)
17	Sandbox
18	Snow sled/Tube/saucer
19	Trampoline
20	Yard games (Bags, horseshoes, Washers, croquet etc.)

#	Permanent Play Equipment
21	Basketball Hoop
22	Backstops (Baseball/Softball
23	Balance Equipment
24	Climbing structure/ropes/wall
25	Fitness Trail
26	Monkey bars
27	Play Structure
28	Slides
29	Soccer Goals
30	Spinning / see-saw equipment
31	Swings
32	Tetherball
33	Track

#	Sports Equipment
34	Baseball/Softball glove
35	Baseball/T-ball bat and equipment
36	Golf Clubs
37	Helmet/Protective Gear
38	Ping Pong Table
39	Racquet (tennis, racquetball, badminton)
40	Rubber bases
41	Skis (downhill, cross-country)
42	Snowboard
43	Snow Shoes

#	Transportation Equipment
44	Bicycle, tricycle
45	Canoe / Kayak / Sail boat
46	Scooter
47	Skateboard
48	Skates (roller / in-line / ice)

#	Water Sports
49	Pool toys
50	Surf / Boogie/Skim board
51	Water skis
52	Wind surf / sail board

Modified from PAMI study (Sirard & Pate, 2001)

equipment is available, but also if it is accessible at that time and where it is located. It is recommended that this instrument be completed by both parents and children.

The use of this new measurement in future studies for a better assessment of the home and school environment is proposed. By grouping common pieces of equipment, researchers will have the ability to specifically identify which category of equipment supports and encourages PA in children and potentially MVPA. If research is able to identify specific pieces of equipment that are more successful than others in different environments, interventions can be developed with this in mind. With the economy unstable and budget cuts affecting schools, purchasing new and replacement equipment can be difficult. If schools had the ability to purchase equipment based recommendations from research, the potential to provide excellent opportunities for PA during recess and save money would be a win-win. A guide could be developed for parents demonstrating several pieces of equipment for the home that would aid them in providing opportunities for the children, family members and friends in their home.

DISCUSSION

This review has provided an overview of the current body of literature focusing on two environments, the home and school, and their relationship with children PA and equipment availability and usage. The review covered all studies completed from January 1980 to March 2012. Originally starting with over 5300 articles, only thirty one met the inclusion criteria and of those thirty one, 16% (5) clearly identified and/ or defined equipment as an environmental variable. Inconsistency in the definition of "equipment", as in playground equipment or physical activity equipment has been evident through this review. Future work should include studies that standardize and

improve the definition to enable cross-study comparison. Equipment was defined as "playground equipment" and defined as "permanent structure equipment" in the same article, describing the same "equipment" (Haug et al., 2010).

Of the studies reviewed, while equipment use was measured and found to be a significant variable, 29% (9), some did not provide any definition or descriptors more than "equipment" (Haug et al., 2010; Loucaides et al., 2004; Saint-Maurice et al., 2011; Trost et al., 2001; Veitch et al., 2006). In Farley et al., (2008) all several pieces of equipment were mentioned with some pieces referred to by different. Hula hoops were also called plastic hoops; playground balls and jump ropes were called sports equipment and game equipment; Fixed play structure and play structure also referred to the same piece of equipment. Equipment was defined three different ways in the same article; as equipment, portable equipment and recreational equipment in (Ridgers et al., 2011).

Understanding the factors that influence childhood PA can aid in the design and implementation of interventions in the main two environments, home and school. Future studies involving the availability and use of equipment should specify the type of equipment used/ or ask about and in the case of interventions the number and type of items used. The effect of the number and type of items used should be assessed for increase PA.

The lack of significant associations found in much of the research examining the relationship between the availability of equipment and children PA may suggest that equipment is not an important influencer on children's PA or it may reflect methodological issues. One of the difficulties in relating equipment characteristics and physical activity may be the lack of agreement in what constitutes "equipment". In

addition, traditionally in the research the measure of equipment has been "availability" or "proximity" of the equipment; however it may be the "use" of equipment that matters.

This study is the first of its kind to investigate the inconsistencies and lack of definition of equipment in the literature. A standardization of equipment would allow for symmetry throughout the literature when evaluating equipment availability as a construct of physical activity.

An instrument has been recommended to achieve this much needed standardization in future studies. Adapted from the PAMI, which was tested for reliability and validity, a clear operationalization of equipment as a factor in increased PA in children may clear up some of the current issues in the literature. As it stands now, if researcher "A" develops a study of environmental factors in the home and their relationship to PA and after analyzing the data, determines that equipment is not significant in this population. Researcher "B" decides that she will now develop a study of environmental factors in the home and their relationship to PA. Once researcher "B" analyzes her data, currently based on reviewed studies, she has less than a 9% chance that she can compare her findings with researcher "A"'s findings because the factor of equipment is not operationalized the same. As studies are developed, and instruments tested, researchers need to improve on their descriptions of what they are measuring and not call everything "equipment".

CHAPTER IV

MANUSCRIPT 3: EQUIPMENT ACTIVITY AND USAGE IN THE HOME AND SCHOOL ENVIRONMENT: IS THERE A RELATIONSHIP TO PHYSICAL ACTIVITY IN CHILDREN

INTRODUCTION

The epidemic of childhood obesity has grown considerably in the United States in the past five years. In the past 30 years, the percentage of obesity in children has tripled (CDC, 2010). Weight gain has a strong genetic influence, however with the increase in cases over the past three decades, environmental factors play an important role (Wechsler et al., 2000). Obesity is one of the easiest medical conditions to diagnose but most difficult to treat. Unhealthy weight gain is due to an imbalance of energy intake, food, and energy output, physical activity (Butte, Christiansen, & Sorensen, 2007). In simple terms, to avoid weight gain, the number of calories expended daily must be equal to or exceed caloric intake. Physical inactivity is a major factor in coronary artery disease and puts individuals at risk for stroke and other cardiovascular risk factors such as Type II diabetes, high blood pressure and obesity. These health conditions that were once seen almost exclusively in adults have become major issues for children and adolescents. The American Heart Association suggests increasing physical activity (PA) and reducing sedentary activity (e.g. watching television, playing video games, or spending time on the computer) as well as parents becoming role models in an active lifestyle that provides children with increased opportunities for physical activity (AHA, 2010). Childhood is an important stage because behaviors and habits related to physical activity are established.

As children age, their physical activity decreases; this decline continues into adulthood, as is well documented in the current literature (Pate et al., 1997; Riddoch et al., 2007; Stathi, Gillison, & Riddoch, 2009). In a recent study, a case was made for promoting moderate and vigorous physical activity (MVPA) in childhood to help reduce weight gain (Fisher, Webber, Purslow, Wardle, 2011). Over the last few decades, our society has been transformed by increased automobile usage, decreased walking and biking, increased indoor activities that are sedentary in nature, and decreased physical education class offerings in school (Haug et al., 2010). Children are no longer sent outside with the instructions: "be home when the streetlights come on." Even so, each day, children are surrounded with opportunities to participate in physical activity, and environmental factors influence their chosen physical activity behavior. Several environments contribute to the PA of children: home, school, neighborhoods, parks, and recreation facilities (public and private). Recent research studies have taken an ecological approach. Ecological models view influences between the setting and individual to guide the physical activity behavior (Sallis et al., 2006). It is within these environmental layers that intervention must take place. Because children spend the majority of their lives in two places: home and school, these environments should become the starting point of any intervention. Interventions in these environments should not only focus on the child, but the people who interact with the child daily.

Environmental Factors

Several environmental factors contribute to the PA of children; home, school, neighborhoods, parks, and recreation facilities (public and private) are just a few. Opportunities surround children daily to participate in physical activity and

environmental factors influence their chosen physical activity behavior. Environmental factors including the availability of school programs, structured programs like sports activities or formal programs (Mota, Almedia, Sentos, Ribeiro, Santos, 2009), community facilities and programs, home access to equipment and facilities (Sallis et al., 2000), physical environments (Felton et al., 2002), and exercise opportunities have all been found to be significant determinants of physical activity in children (Gordon-Larsen et al, 2000; Lindquist et al.,1999). Physical environments have the ability to hinder physical activity through lack of resources (King et al., 1995), inclement weather, and higher crime rates (Sallis et al., 1997). In order to develop interventions and measure their effectiveness, it is imperative to understand home and school environments that influence PA behavior in children.

Home Environments

For children under the age of 12 years, the home environment has also been suggested as critical for providing access to healthy foods and opportunities for physical activity (Kumanyika, 2008; Millstein et al., 2011). The parental influence on the development of obesity is apparent. Children of overweight parents are 70% overweight are more likely to be overweight themselves (Davison & Lawson, 2006). While genetic factors may be at play, home environmental factors such as the presence of healthy role models, the availability and accessibility of food items and physical activity opportunities are also potential mechanisms that could explain the parent-child overweight relationship. Many studies have shown increased sedentary behavior due to multiple televisions in the home and even the child's room is associated with, reduced

physical activity (Davison & Lawson, 2006; Fein, Plotnikoff, Wild, & Spence, 2004; Giles-Corti, Timperio, Bull, & Pikora, 2005).

During childhood opportunities and motivation for PA factors are principally determined by the parent. Other influences at this age also include peers and influences at school. Parents control the social and physical environment such as the availability of equipment, transportation to PA activities outside of school hours, physical activities opportunities in the home, rules involving outdoor play, media interaction and nutrition, rules. Upon entering adolescences parental and school influences are still present however peers start to take on a more important role (Ogden, Carroll, Kit, & Flegal, 2012). A shift in participation in PA also occurs between adolescence into adulthood (Flegal et al., 2010).

Home environments that can promote physical activity include the presence of equipment, recreation opportunities, and yard space (Salmon & Okely, 2009).The presence of and access to home equipment in and around the home was associated with greater PA in children (Bryant et al., 2008;Huang, 2011; James F. Sallis et al., 2000; Trost et al., 2001).

Children were asked to draw maps of the places they participated in PA and include anything involved with these opportunities of PA (Hume et al., 2005). In over fifty percent of the maps and pictures returned, the home environment was the most documented. Back yards and cul-de-sacs were the next two highest. Bryant et al. (2007) reported a significant association with play equipment in the yard and bicycles. Much of child play time occurs in yards (Timperio et al., 2006; Timperio, Crawford, Telford, & Salmon, 2004), and time spent outdoors is correlated with physical activity (Crawford et

al., 2008; Telford et al., 2005), so outdoor play space is important for physical activity. One of the main issues parents noted about outdoor play was a safety factor of having children outside playing without adult supervision; however in two different studies, (Crawford et al., 2008; Hume et al., 2005), parents felt safer allowing children to play in front of their house if they lived on a cul-de-sac versus a street. These studies suggest that the availability of safe and convenient home-based recreation opportunities promote children's physical activity.

School Environments

The school environment can implement and facilitate interventions during several time periods throughout the day such as before and after school, Physical Education (PE) class, and recess. Spending 60-70% of their day in school creates an opportunity to provided and encourage children during these times to participate in programs that increased the MVPA, they may be able to attain the majority of the recommended 60 minutes of PA needed(Wechsler et al., 2000). With school district budget cuts and concern over academic performance on standardized tests, recess and PE classes are being cut. Attempts have been made to reverse the perception of PE being less important than core classes such as English, math, and science.

Both recess and PE provide opportunities for PA outside of the classroom however they are not the same. Children use recess to socialize, choose their levels of PA and develop their own games and rules. On the other hand, PE tends to be more structured and usually requires more PA, especially in girls who have shown to be less physically active during recess by choosing more sedentary and social activities (Willenberg et al., 2010). The National Association for Sport and Physical Education

(NASPE) advises that "regular physical activity" add up to about one hour per day, every day. A majority of states mandate physical education, although most do not specify the amount of instructional time. According to the NASPE & American Heart Association (2012), only three states (Alabama, Florida, and Louisiana) require the nationally recommended 150 minutes or more per week of physical education. Just 18% of states require elementary schools to provide daily recess. Students spend more time in recess than in physical education classes Robert Wood Johnson, (2007)

Recess is opportunities to have students achieve the recommended MVPA within the timeframe of the school day. Several studies have shown an increase of PA is significantly associated with the improvements made to playgrounds such as repainting lines (Ridgers et al., 2010b), renovating play structures (Beighle et al., 2006; Jones et al., 2010; Stucky-Ropp & DiLorenzo, 1993) and the addition of staff organizing games (Verstraete et al., 2006; Willenberg et al., 2010; Zask et al., 2001)

When children were given a choice on where they could play, they were drawn to areas with fixed play equipment (Farley et al., 2008), newly renovated play areas and equipment(Sallis et al.,2006) and higher density areas in general they were more likely to be physically active. However, Zask et al. (2001) found no association in availability of playground equipment (except sports/playground balls) and children's PA. Choice, availability, an self-efficacy are also motivators of PA during recess as established in several studies

Equipment

Equipment plays a role in the fight against childhood obesity, but to what extent is still unknown. There is a growing body of literature that found its roots in Sallis et al.,

(1997) and the development of the Physical Activity Environment and Home Equipment scales (Sallis et al., 1997). Based on this study and the *Home Equipment scale*, equipment availability was moderately correlated with frequency in both vigorous and strength exercises. (Sallis et al., 1997). As one of the earliest acknowledgments of the importance of equipment, it is an instrument with validity and is currently used in studies.

In several studies, girls are shown to have less MVPA on the playground and tend to use the unstructured free time as a social time spent walking talking standing or sitting with friends (Saint-Maurice et al., 2011). Hispanics have be shown to have less equipment and more sedentary time at home (Bryant et al., 2008; McKenzie et al., 2010) and to participate less during recess activities and in a study that looked at the number of places (11) that children participated in PA, the Hispanic population visited less spaces but the one that they did visit, the visited more.

Introduction of game equipment (balls, hoops, and jump ropes) saw an increase of MVPA from 48% to 61% during recess (Verstraete et al., 2006), 35% to 50% by painting surfaces suggesting games (Stratton & Mullan, 2005) and loose play equipment renovated play fixed structure (Anthamatten et al., 2011).

Several early studies in the area of environment as a factor of increased PA, where equipment was a focus, there was no association between home equipment and PA among preschool children (Sallis, 1997) and adolescents (Dunton, Jamner, & Cooper, 2003; Trost et al., 1997; Trost et al., 1999) documented. Findings in a study of adolescent girls provided evidence for perceived equipment availability as a means of increasing self-efficacy and overcoming barriers to physical activity (Durant et al., 2009;

Millstein et al., 2011; Motl, Dishman, Saunders, Dowda, & Pate, 2007). The perception of availability of equipment in the home and school environments was suggested to increase physical activity through increasing the perceived self-efficacy (Dzewaltowski et al., 2010; Farley et al., 2008) Examples of equipment in the home environments were balls and bikes while the community examples were playgrounds and parks.

The lack of significant associations found in much of the research examining the relationship between the availability of equipment and children PA may suggest that equipment is not an important influencer on children's PA or it may reflect methodological issues. One of the difficulties in relating equipment characteristics and physical activity may be the lack of agreement in what constitutes "equipment".

Present Study

Data for this study was derived from a larger NIH study entitled, *Student Wellness Assessment and Advocacy Project (*SWAAP). SWAAP focused on selected elementary school children and their parents in Waller County, Texas. The study area is comprised of geographical and racial/ethnic health disparate populations. The overall objective of the SWAAP was to design, implement, and evaluate the efficacy of a cultural-appropriate multi-level intervention to prevent childhood obesity. The present study will examine the relationship between the availability and usage of equipment in the home and school environments on children's physical activity.

METHODS

Study Design

The study is a cross-sectional survey design. Parents (n=298) completed the survey based on their currently enrolled in the fourth grade. Participants were recruited

from seven schools across three rural school districts (Royal ISD, Hempstead ISD, and Waller ISD). Questionnaires were distributed through the schools. First distribution occurred August 2010 at local schools' "Back to School Night." Members of the research team met with parents of fourth graders in attendance and invited them to participate. Additional questionnaires, consent forms, and letters inviting parents to participate were sent home in school mailings with students in September 2010. A total of 767 questionnaires were distributed with 316 returned. Written reminders to parents to complete and return the questionnaires and consent forms were sent home with students in October 2010.

All written material (questionnaires, consent forms, letters) were published in English and Spanish. Each parent/child duo received a $25 gift card for completion of the questionnaire. There were two phases of data collection, pre-intervention and post intervention. The analysis for this study will focus on data from the pre-intervention.

A community profile of Waller County Texas, located in the northwest of Houston, Texas, is 519 square miles with a 2010 population of 43,205. Major communities within the county lines are Hempstead, Brookshire, Prairie View, Katy, Waller, Pine Island, and Pattison. Seventeen percent of the population is in poverty with 22.8% of the population under the age of 18. The Census Bureau (2000) listed the ethnicity makeup of the county as Hispanic: 19.4% ; White:57.8%; African American:29.2%; American Indian and Alaska Native: 0.5%; Asian: 0.4%; and Native Hawaiian and Other Pacific Islander: 0%.

The SWAAP involved children (7-10 years), parents, and school stakeholders (teachers, staff, and administrators) of all ethnic groups and from both genders. There

were no exclusions by gender or ethnicity. However, the lower age limit of (7) and upper age limit of (10) was set for the elementary school children as the survey instrument was designed for 2nd to 4th grade students only for this study. Parents needed to be 18 years and older to participate. In compliance with the NIH requirement, this c research project went through full IRB review at Texas A&M University and Prairie View A&M University as well as Waller, Hempstead, Royal, and Bryan Independent School District (ISD) research ethnics' approval committee before data collection began. Parent consent and child assent were received. The IRB will review the project annually to ensure the ongoing protection of project participants.

Measures

Phase 1 of the SWAAP was a multi-phase study that included a formative phase utilizing focus groups to elicit strategies to tailor the intervention. Variables identified in phase 1 were utilized in phase 2 n instrument development of 157 items developed and presented to the parents of the fourth students. The questionnaire included measures of demographic information, and subscales specific to nutrition and physical activity. The following is a summary of all the measures used in the present study.

Physical Activity

The current study includes a measure of PA that assesses for the frequency of PA as well as the availability. The amount of PA reported was measured with an item from the *Active Where?* (Sallis, 2009) survey using the following two questions, "For the past seven days, how many days was your child physically active for a total of at least 60 minutes per day?" and "Over a typical or usual week on how many days is your child physically active for a total of at least 60 minutes per day?" Written instructions prior to

the items read as follows, *"Physical Activity is any activity that increases your child's heart rate and makes your child get out of breath some of the time. Physical Activity can be done in sports, playing with friends, or walking to school. Some examples of physical activity are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball, football, and surfing. Add up the time your child spends in physical activity each day (do not include school physical education or gym class). Circle the answer that best applies to your child."*. Response items for these questions ranged on scale from 0-7 days, with the higher score indicating more days of PA. These two items were recoded after reviewing the distribution. Three distinct groups were created for each of these items, " Group 1-low activity" (*n=98)*, " Group 2- average activity" (*n=93)* and " Group 3-high activity" (*n=107)* with a higher score indicating more activity. The groups were created based on the evenly distributed numbers. This grouping of variables was done based on the even distribution of the population once combined and previous studies had group children with similar PA averages (Riddoch et al., 2007; Saunders, Prince, & Tremblay, 2011; Trost et al., 1999).

Home Environment

Availability of equipment was assessed with a list of 14 items; please see Table 8 for a list of these items. Participants were asked to, *"Please indicate if you have the following items in your home, yard, or apartment complex, and if you have them, how often your child uses each item. Please circle the answer that best applies to your child.*

Table 8: Equipment availability per household (N=298)

Piece of equipment	*n*	%
Bike	254	85.2
Sports Equipment*	234	78.5
Jump Rope	150	50.3
Roller skates, skateboard, scooter	142	47.7
Basketball Hoop	129	43.3
Fixed play equipment**	120	40.3
Trampoline	113	37.9
Swimming Pool	108	36.2
Exercise, play or REC room	101	33.9
Home aerobic equipment***	100	33.6
Stairs	97	32.6
Weight lifting equipment toning devices ****	74	24.8
Yoga/exercise mat	32	10.7
Water or Snow equipment*****	24	8.1

* e.g., balls, racquets, bats, sticks

** e.g., swing set, play house, jungle gym

*** e.g., treadmill, cycle, cross trainer, stepper, rower, workout video or audiotapes

**** e.g., free weights, pull-up bars, exercise balls, ankle weights

***** e.g., skis, skates, canoe, row boat, kayak, surf board, boogie board, windsurf board

The response ranged from 0 = Not Available, 1= Available but never use, 2=Use once a month, 3=Use once every other week and 4= Uses once a week or more". Since measurement of availability of equipment was the ultimate goal, the author recoded the equipment variable into two new variables, "have or not have" and "use or not use". The recoding gave the researcher the ability to assess two pieces of information for each item and to determine if equipment was available, were they using it? If they were using the equipment, did this have an association with increased PA?

School Environment

After school and recess measurements were assessed with the following questions: (a) "Outside of school, how many days per week does your child play or practice team sports?," (b) Outside of school, how many days per week does your child have activity training or instruction not in a team sport (e.g., martial arts, dance, tennis)?", response items for these questions ranged on scale from 0-7 days, with the higher score indicating more days of PA. The other school environment measures assessed proximity to the school, (c) "Is your child's school within a 30 minute walk or bike from your home?" answered with a yes or no. Assessing the child's physical school environment was a list of large scale equipment, (d) "Does your child have any of these at school? Circle all that apply" answer choices were a "Yes", "No" or "Don't know". Choices included: Basketball hoops, soccer goal post, baseball backstop, playground markings, things to climb, running/walking track, weight lifting machine, and indoor exercise machines (such as a treadmill or stair climber). And for the last measurements of school environment, assessment of the school facilities were addressed with the

following, (e) “How often does your child’s school have supervised physical activities after school?”, (f) “How often does your child’s school allow students to use play areas or fields after school?”, and (g) . How often does your child’s school allow students to use play areas or fields after lunch?” addressing the lunch recess. The response items for these questions were, “ never”, “rarely”, “sometimes”, “frequently”, “always” and “don’t know” These three variables were each recoded after running the distribution. The three distinct groups were, “don’t use”, “use” and “don’t know”.

Socio-demographic Data

Variables for ethnicity, income, marital status and parent education were re-coded into new variables. Race was measured as “Hispanic Non-Hispanic” due to the 50.2% Hispanic population; income was recoded into three new variables, “Group 1 Low- $30,000 and less, Group 2-Medium $30,001-$70,000, and Group 3- High $ 70,001-above $100,001” This recoded variable was not used to establish average income. Marital status was recoded as “Married or Not married” with the assumption that “married” was a dual parent household and any of the other marital status were single parent homes. The education variable, was recoded into the new variables, “ Group 1-> high school graduate, Group 2- High School or GED graduate, and Group 3- some College”.

RESULTS

Data collected for this survey were analyzed using Statistical Package for Social

Sciences (SPSS version 18), and reports were generated on the population as whole and individual school. Pearson chi square tests were used to compare total weekly activity between boys and girls. Independent *t* tests were used to compare the frequency of use and availability of equipment by sex and by race. In all analysis *P* values were considered statically significant at <.05.

Sample Characteristics

Descriptives and frequencies were run for all variables. Demographic sample characteristics are included in Table 9. The sample consisted of 298 parent surveys completed. The average income was M= 3.72 (SD = 2.88) which is between $25,000-$35,000 however 63.1% were considered low income. Race measured 50.2% "Hispanic" and 49.8% "Non-Hispanic". The majority of children are living in a household of married parents (69.9%) and only four (1.7%) did not have custody of their children full time. Parental education was evenly distributed between the three education variables (> high school graduate = 32.1%, High School or GED graduate=28.9% and some College=39%) with the "College" group at a small majority. Parents reported that their fourth grade children participated in physical activity an average number of 4.51 days (SD= 2.25) and 48% of children were active 4 days or more.

Table 9: Demographics of the study population (N=298)

	n	%
Gender of questionnaire contact		
Female	257	12.9
Male	38	87.1
Gender of child		
Female	155	52.2
Male	142	47.8
Highest Education of Contact		
Not High school/GED graduate	89	32.1
High school/GED graduate	80	28.9
Some college or college degree	108	39.0
Marital Status		
Single, Widowed, Divorced or Separated	88	30.1
Married	204	69.9
Income of contact		
$0-$30,000	171	63.1
$30,001-$70,000	52	17.4
$70,001-$100,000 and above	48	16.1
Ethnicity of contact		
Hispanic/Latino	143	50.2
Not Hispanic/Latino	142	49.8

Home Equipment

The availability of a bike (85.2%) or sports equipment (78.5%) was available in homes. There were three pieces of home equipment usage that significantly differed by gender, basketball hoops ($p>.001$) and weights ($p>.001$) for males and jump ropes ($p>.000$) for girls (Table 10).

A one-way ANOVA analysis indicates that physical activity measurements in the three physical activity groups differed. In table 11, the means and standard deviation of

the variables “Equipment availability” and “Equipment use” between groups are presented.

Table 10: Equipment availability and usage by gender

Piece of equipment	Boys		Girls	
	Have %	Use %	Have %	Use %
Bike	84.5	95	85.8	91.7
Basketball Hoop	54.2	88.3	33.5	88.5
Jump Rope	33.8	75.0	65.8	85.3
Sports Equipment*	83.8	93.3	74.2	88.7
Swimming Pool	38.7	94.5	34.2	100
Roller skates, skateboard, scooter	52.8	90.7	43.2	83.6
Fixed play equipment**	33.8	87.5	46.5	100
Home aerobic equipment***	32.4	69.6	34.8	74.1
Weight lifting equipment toning devices ****	31.0	56.8	19.4	40.0
Water or Snow equipment*****	9.2	84.6	7.1	90.9
Yoga/exercise mat	17.0	29.4	9.7	73.3
Exercise, play or REC room	32.4	91.3	35.5	98.2
Trampoline	34.5	98.0	40.6	98.4
Stairs	31.0	93.2	34.2	98.1

* e.g., balls, racquets, bats, sticks

** e.g., swing set, play house, jungle gym

*** e.g., treadmill, cycle, cross trainer, stepper, rower, workout video or audiotapes

**** e.g., free weights, pull-up bars, exercise balls, ankle weights

***** e.g., skis, skates, canoe, row boat, kayak, surf board, boogie board, windsurf board

Table 11: Means and standard deviations for three activity groups and two independent variables

Variable	Low Activity (N=98)		Medium Activity (N=93)		High Activity (N=107)	
	M	*SD*	*M*	*SD*	*M*	*SD*
Equipment Availability	5.24	3.04	5.77	2.66	5.86	2.74
Equipment Usage	4.34	2.61	5.15	2.39	5.35	2.7

Table 12 illustrates the ANOVA of physical activity and equipment availability and use. Analysis of the data showed significance in the low activity group with equipment usage but not the medium or high activity groups, ($F= 4.303$, $p < .01$) and no significance for all groups in relation to equipment availability ($F=1.365$, $p< .01$). All groups had equipment availability and there was no significant difference between groups; however the lower activity group had a significant association with lower levels of PA.

Table 12: One-Way analysis of variance summary table for physical activity measurements and equipment availability.

Source	*SS*	*MS*	*F*	*P*	$\eta 2$
Equipment Availability					
Between	22.12	11.06	1.395	.250	.275
Within	2339.28	7.93	_	_	
Equipment Usage					
Between	57.36	28.68	4.303	.014	.595
Within	1965.99	6.66	_	_	

Table 13 presents correlates of average weekly physical activity occurrences with home equipment availability and home equipment usage. Higher averages of weekly physical activity were significantly associated with home equipment availability ($p<.002$) and home equipment usage ($p<.000$).

School Environments

Current analysis indicated that school environment has no significant association with available equipment and physical activity levels ($p<.292$). In addition, there was no significant association of school facility usage and proximity to the school ($p<.119$).

Regression

Linear regression was performed to assess the impact of several factors and the total average physical activity. The model contained three independent variables (gender, ethnicity, and income). Although there was a significant predictor (F= 9.27, P<.004) only 2.4% of the variance was accounted for in the variable for race (Table 14).

Table 13: Intercorrelations for typical week's physical activity and two home equipment measures

Measure	1	2	3
1. Typical Week Physical Activity	-	.002**	.000**
2. Home Equipment Availability	.002**	-	.000**
3. Home Equipment Usage	.000**	.000**	-

** Correlation is significant at the 0.01 level (1-tailed).

Table 14: Summary of linear regression analysis predicting average weekly physical activity

Variable	*B*	*SE*	*Beta*	*p*	R^2
Child Gender	*-.216*	*.289*	*.049*	*.069*	*1.9*
Household Income	*-.129*	*.060*	*-.172*	*.332*	*.7*
Ethnicity	*.773*	*.332*	*.176*	*.004*	*2.4*

DISCUSSION

The associated health issues, increased cases of obesity and the small percentage of children attaining the recommended daily MVPA are all factors driving parents, communities and researchers in the discovery of which environmental interventions encourage PA among children. The purpose of this study was to investigate the environmental factors of the fourth grade student sample through the parent's perception of physical activity, equipment availability and use, school and household barriers and resources for physical activity.

In previous studies, gender, race, and lower SES have been shown to be determinates of PA, those with lower socioeconomic status (Ridgers et al., 2011), minority race (Corder et al., 2011; McKenzie et al., 2008a)and females (Baranowski et al., 1993; Durant et al., 2009)were more likely to report less physical activity, which is consistent with previous studies (Gordon-Larsen et al.,2000; Sallis et al., 1997). The study's results were significant with the association of increased inactivity within Hispanics and males; however the SES was not a significant factor.

Availability and use of equipment in the home and school environment and their relationship with PA in children were the factors driving this study. These factors were subjectively measured through the parental survey and this type of measurement as a solo measurement is not ideal. Self-reporting may be unreliable, especially by very young children, and it provides less accurate information on physical activity behavior than objective measures of physical activity, such direct observation (Bryant et al., 2007)

However, because the questionnaire was based on a validated instrument (Sallis et al., 1997) and was carefully pre-tested, the author believes it provided information that was as accurate as possible.

If the equipment was present in the home and the children used it, their PA activity levels increased. One piece of home equipment, a bike, was owned by 85% of the population and potentially would be an avenue for a home intervention. Of the 85% of bike owners, both boys and girls were in the 90% of use, with boys using their bikes 95% and girls 92% of the time. A previous study, Bryant et al.,(2008) same findings of bike or riding toy in 98% of the homes as reported by parents (low Kappa 0.06, 95% CI=.-0.11-0.22).

Current analysis indicated that school environment has no associations with available equipment and physical activity levels. An interesting aspect of the data is that parents answered "don't know" at least 30% of the time for the availability of facilities after school, after lunch, and the availability of PA after school that took place at the school. In addition, there was no significant association of school facility usage and proximity to the school. Of the completed questionnaires over 80% of the students lived at least a thirty minute bike ride or walk to the school grounds, making it difficult for a child to get to school on their own.

Application of the results of the current study to the greater population is limited by the small sample size; however the current study did bring to light some resources. In the school environment questions, reliability of the information is small since a third of the parents were unable to provide information an answer of availability in terms of

school grounds and fields after school as well as availability of facilities after lunch. This may highlight an opportunity for outreach on the part of the school, parent teacher organization, or greater community.

Study Limitations and Recommendations

Application of the results of the current study to the greater population is limited by the small sample size; however the current study did bring to light some resources. In the school environment questions, reliability of the information is small since a third of the parents were unable to provide information an answer of availability in terms of school grounds and fields after school as well as availability of facilities after lunch. This may highlight an opportunity for outreach on the part of the school, parent teacher organization, or greater community

This study used parental perception as a measurement of PA. Issues with this measurement can include bias, inconsistency of information and missed PA occurrences. When asked if their child is physically active, a majority of parents will answer yes even though it may not be the complete truth, so they do not feel they are failing their children. Some information may be exaggerated to provide a better picture of health as well as information that is left out because the parent is unaware. Physical activity was not measured objectively. Further studies should be considered for this area due to the perception of equipment availability and use may differ for the child then the parent. While parents may have knowledge of a piece of home equipment, their child may not. And asking the parents to estimate usage can difficult also due to the nature of children who have been known to use objects for more than their intended purchase.

Another limitation of this study is the socio economic status of the families. Parents were asked to provide "their income" in which 16% left the question blank. There may have been confusion as to which income figure they were to provide researchers. It could have been interpreted as the income that they personally bring into the home or the income of the household.

In past studies on the home and school environment, equipment availability is a factor of interest. What has not transpired in the literature is the tracking of usage. Pieces of equipment can be available to individuals; it is the types of equipment and the use of the equipment that may prove to be helpful in designing interventions. Parents noted that 38% of their homes had a trampoline, which was used 98% of the time. Another item, "exercise, play, or rec room" was available in 33% of the home and had a use rate of 95%. Some items may prove to be expensive for families and are not available; however if studies focus on usage as well as availability, a comprehensive list could be developed as an aid in providing as many opportunities for PA in the home environment.

Another limitation with the study is the small sample size due to age restriction of fourth graders. Data was limited to the parents of fourth graders which average age ten. At ten years old most kids have decided what things they enjoy in the form of physical activity. Understanding children's patterns at an earlier age may provide for interventions in the home and school prior to pre-adolescents.

Conclusion

While encouraging physical activity among children through their environmental factors, availability of equipment is a predictor of increased PA.

The importance of the home and school environment and the availability of equipment is an area of study that is still in its infancy. The home environment can shape how children spend leisure time. Several factors influences children's physical activity levels and have been addressed in the current body of literature. Environmental factors may create barriers for children to engage in the recommended MVPA including social economic status (SES) in relationship to available resources. Researchers have found that higher rates of physical activity have been associated with access to play spaces and equipment in predominately middle class samples of adolescents (Sallis et al., 2000). Minority children are more likely to live in low-income neighborhoods and report fewer facilities/locations for physical activity such as community centers, schools and parks (Sallis, 2009).

The importance of the home and school environment and the availability of equipment is an area of study that is still in its infancy. The home environment can shape how children spend leisure time. For example, many studies have shown increased sedentary behavior due to multiple televisions in the home including in the child's room. This increase in sedentary behavior is associated with reduced physical activity which affects the energy imbalance and is linked to being overweight.(Davison & Lawson, 2006; Fein et al., 2004; Giles-Corti et al., 2005). Home environments that can promote physical activity include the presence of equipment, recreation opportunities, and yard space (Salmon & Okely, 2009).The presence of and access to home equipment in and around the home is associated with greater PA in children (Trost et al., 2001). Much of child play time occurs in yards (Timperio et al., 2006; Timperio et al., 2004), and time

spent outdoors is correlated with physical activity (Crawford et al., 2008; Telford et al., 2005), so outdoor play space is important for physical activity. These studies suggest that the availability of safe and convenient home-based recreation opportunities promote children physical activity.

CHAPTER V

SUMMARY AND CONCLUSION

INTRODUCTION

One in three children is considered obese or overweight. Type II diabetes, heart conditions and the potential stroke are conditions children should not have to experience in their young lives. We are an unhealthy nation, and we are not modeling healthy behaviors for our children. Children from low-income families are at an even greater risk for obesity due to a lack of available resources. Parents influence their child's weight status through both the social and physical components of the home physical activity environment.

Physical activity is much more than weight loss. Incorporating PA in the lives of children early in development has many positive outcomes. Physiological and Physical benefits have been established in the literature. Psychologically, PA offers emotional benefits including stress reduction, increased self-esteem and lower anxiety. Physical benefits of PA can include stronger bone and muscle structure, cardiovascular system strengthening, increased immunity system and increased blood flow to vital organs including the brain.

National recommendations encourage children to engage in 60 minutes of PA daily and within that 60 minutes at least 30 minutes three times a week should be moderate to vigorous physical activity (AHA, 2010). Currently the majority of children and adolescents do not meet the recommended daily physical activity numbers.

Home and school physical activity equipment plays an important role in facilitating children being active in the convenient physical activity locations that are used most often. Since all children can be active on a daily basis during recess, recess periods are important opportunities to promote PA at school.

The purpose of this study was to explore the relationship of equipment availability and increased PA in the home and school environments. This objective was accomplished in three ways: 1) A systematic literature review was performed to examine the current theoretical framework or model studies are using when evaluating environmental factors contributing to occurrences of PA in children ages 5-12 in the home and school environment; 2) A systematic literature review was performed to examine how equipment is defined and operationalized in the current body of literature; and 3) An analysis of secondary data from a NIH study was performed to determine the factors influencing PA in fourth graders.

This chapter provides a summary of each of the three manuscripts, implications for researchers, limitations and recommendations for future research and a final conclusion of this study.

Summary of Manuscript 1: Systematic Literature Review

The systematic review (Manuscript 1, chapter 2) sought to identify the theoretical framework and models currently driving the literature of equipment and its relationship to PA in children 5-12 years old in their home and school environment . The reviewed studies were coded and specific characteristics recorded and theoretical framework and

models were identified if present. Theoretical framework and models were also scored for use or operationalization within the study itself.

This review demonstrated a lack of theoretical framework throughout the articles was evident as well as the amount of articles on the topic. Over half (53%) of the studies reviewed were absent of any theory or framework. Of the remaining studies that used theoretical framework or a model only 14% provided enough detail of the theory for readers to be informed on the reason for selecting the particular theory and how the theory or model when applied to their study , should support their findings. To strengthen the validity of the research, a solid theoretical framework needs to accompany the study. It is the use of a theory that adds reliability and should be the driving force of the study.

The Social Cognitive Theory (SCT) was used 100% of the time in articles that identified their theoretical framework. It is one of the most predominant theories used in health research involving physical activity. SCT suggests that the continuous interaction between an individual and their environment. SCT also focuses on a person's self-efficacy and their confidence in the ability to attempt challenges.

The Socio-Ecological Model (SEM) was present in 75% of the studies reviewed that used a theory or model. The SEM also functions on the premise that an individual is influenced by their environment, the model really defines the different environments and the influence each level may have. The individual brings knowledge, skills and attitudes while the interpersonal relationships are their family, peers and social networks. The next level is the organizational level which includes social institutions as well as other

organizations. The last two levels that influence individuals would include the community and public policy. It is the interaction between these five levels that influence an individual and their behavior.

In conclusion, the results of the systematic literature review clarified the theoretical gaps in the body of literature. It provides a direction for researchers in future studies. One consideration in reviewing the data is that researchers could have used a theory or model to develop their study and the studies may be theoretically based. Without including this information in the article write up, studies appear to be without any theoretical foundation.

Summary of Manuscript 2

The systematic review (Manuscript 2, chapter 3) sought to identify equipment is identified and defined in its relationship to PA in children 5-12 years old in their home and school environment. The reviewed studies were coded and specific characteristics recorded. The presence of equipment as a factor was identified and the definition was also scored for use or operationalization within the study itself.

Within the review itself over seventy percent (76%) acknowledged that equipment was a factor in increased physical activity, but failed to define the equipment itself in over ninety percent of studies. This review was performed to identify a definition of the factor "equipment"; however want was surprising was the fact that no definition was given in any of the articles. If the word equipment was described, it was in a format that included the word equipment with several examples of pieces of equipment that were included in the study. Very rarely were all pieces of equipment

identified and several studies used just the word equipment with no reference.

Without a consistent identification of what constitutes equipment in the study, the ability to compare results becomes difficult if not impossible. One study that finds that equipment was associated with higher rates of physical activity, may have been looking at play structure in a school yard while another study refers to a collection of balls, jump ropes, and bats as equipment. Two very different sets of items, with different forms of physical activity associated with them but still labeled under the same variable of "equipment'. Defining equipment allows for interventions to be developed that can be used in several scenarios in promoting physical activity.

The inconsistencies of the identification of equipment in the literature are so plentiful; multiple studies used different names in the same article, identifying the equipment by two different names. Neither name provided any indication what type of equipment was being referenced.

This manuscript clearly confirms the lack of standardization in identification and measurement of the factor, equipment. Until there is a stand process that is recommended and used, studies are not truly able to relate to one another unless the exact instrument is used in each study. As a recommendation, the author designed an instrument based on a previous instrument that places pieces of equipment into different categories. The instrument not only allows for the researcher to establish the availability of equipment but to also tracking the location, ease of access and usage of each piece of equipment. Studies that use the suggested instrument would be able to make generalizations of type as well as specific pieces of equipment.

Summary of Manuscript 3

The study, (Manuscript 3, chapter 4) analyzed data from a larger study, *NIH, Student Wellness Assessment and Advocacy Project (SWAAP),* conducted in Waller county Texas, 2010. Based on current studies, several factors including race, gender, and equipment availability are significant in the PA behaviors of children 5-12 years of age. Will these same factors be significant in the population studies in regard to equipment availability and usage? Results from this study will add to the current body of knowledge on determinants of PA in children ages 5-12 years. This is important due to the lack of literature specifically for the age group.

The data was limited by age (only fourth graders), and amount of questionnaires returned. One socio-demographic variable was significant in its association with overall PA, race. As in the literature, being of Hispanic race was associated with less overall PA. A backward stepwise regression analysis with children's socio-demographic characteristics (gender, race, and SES,) as independent variables and the PA level for a seven day period as the outcome variables was conducted. Race was significant in lack of overall PA; however the variance (2.4%) explained by the significance was extremely low, most likely due to the population sample. Other demographic factors such as gender and SES were not significant with this study.

Prior research has found that equipment availability or perceived availability was positively associated with increased PA and even MVPA (specifically during recess) which was expected in this study. This occurred with correlations of equipment

availability ($p<.001$) and equipment usage ($p<.001$) being significant in overall PA for an average seven day period.

PA and equipment availability was subjectively measured through parental perception. The instrument which used PA measurements and equipment availability measurements from a validated study (Sallis et al., 1998) does not arrange for impute for the students themselves. In several studies reviewed in Manuscript 1, an instrument similar to the one used in our study, was accompanied by objective measurements of PA either through a mechanical device (pedometer or accelerometer) or observationally by trained staff. Parents are not with their children during the day at school and or during time periods in the evening. Parents would be completing the survey based on assumptions and/or recall from their child if asked. Studies have shown that self-reporting or parental reporting is not consistent.

While several outcomes of this study are consistent with the current literature, due to the low variance explained, the findings should be interrupted with caution.

LIMITATIONS

This study has several limitations that need to be taken into consideration when interpreting the findings. Choosing to review articles only associated with children age 5-12 years may be a limitation due to the fact that other articles may in fact hold key pieces of information that has not been applied to this age group. The author felt that highlighting the literature specific to this age group would allow researchers to recognize the lack of resources available to individuals creating interventions.

Research has been completed on many age groups but the elementary school age group is lacking. Elementary aged children potentially are the group where interventions may work the best in a school environment. Early education environments do not meet on a daily basis and secondary aged students have schedules that can be difficult to work within.

Equipment is not standardized throughout the literature and in numerous studies the reader is unable to understand what is being measured. When the studies provide the results, if the availability of equipment is a factor in increased PA, how is the reader to interrupt what type of equipment is a factor?

The investigator was not able to control for all of the variables involved in the collection of data for the third manuscript. Those variables include: amount of returned surveys, development of the measurement instrument, the shortage of information from the students and a lack of objectively measured environment and PA.

FUTURE STUDIES

These finding from these studies support an ecological approach for interventions involving children and the promotion of physical activity. Applying multilevel framework interventions focusing on the home and school physical environments and the availability of equipment is needed. In order to develop interventions that work on these multi-levels, studies that are theoretical empirical in nature need to be conducted, the results can then be applied to larger populations and sub-populations

Further, this study provides additional support to a growing body of evidence that measurement of "availability" of equipment should include usage measurement as well

as type of equipment. These findings contribute to the body of research on environmental correlates of physical activity and interventions based on an environmental model.

There is a need for studies that measure PA and factors affecting PA behavior in children that use both subjective and objective measurements. Earlier studies on physical activity have shown that adults overestimated their own physical activity level. If they are not with their child twenty-four hours a day, their information is based on assumption or self-reporting from the child.

CONCLUSION

This study attempted to address the childhood physical inactivity problem by exploring equipment as an environmental factor in increasing PA. Given that PA is linked with physical, psychological and academic benefits, it is important to establish evidence based interventions that can increase a child's opportunity for PA.

Findings from this study have implications for research on children's environments and their association to PA. The study provides evidence of a lack of sound theoretical framework or model in the literature and the deficiency of literature on children 5-12 yrs. specifically. This study provides evidence to support the home and school environments as a platform for interventions of increasing physical activity in children.

Future work is needed to evaluate the home and school environment and to advocate for an increase in PA in school aged children. Given our knowledge of the SEM and the home environment should be the springboard for increased PA. Home and

backyard PA can involve family and friends, and support individual pursuits of PA. Children don't play the way they used to: outside, unsupervised, and with few imposed rules. Given our knowledge of the benefits of PA , creating a supportive environment for children's PA to occur is essential for the next generation.

Use of equipment may be a simple intervention however more studies on the type, amount and availability of equipment is necessary. During these times of school cuts and an economic down turn, in an effort to increase a child's MVPA during school recess or other free time, and create a supportive environment at home, low cost inventions of additional equipment may be a temporary fix.

REFERENCES

Adkins, S., Sherwood, N., Story, M., & Davis, M. (2004). Physical Activity Among African-American Girls: The Role of Parents and the Home Environment. *Obesity Research, 12*(supplement), 38S - 45S.

Ahn, S., & Fedewa, A. L. (2011). A Meta-Analysis of the Relationship Between Children's Physical Activity and Mental Health. *Journal of Pediatric Psychology*. doi: 10.1093/jpepsy/jsq107

American Heart Association. (2010). Physical Activity and Children. Retrieved April 13th 2012, from http://www.heart.org/HEARTORG/GettingHealthy/Physical-Activity-and-Children_UCM_304053_Article.jsp

Anthamatten, P., Brink, L., Lampe, S., Greenwood, E., Kingston, B., & Nigg, C. (2011). An Assessment of Schoolyard Renovation Srategies to Encourage Children's Physical Activity. *International Journal of Behavioral Nutrition and Physical Activity, 8*(1), 27-31.

Baranowski, T., Thompson, W., DuRant, R., Baranowski, J., & Puhl, J. (1993). Observations on Physical Activity in Physical Locations: Age, Gender, Ethnicity, and Month Effects. *Research Quarterly for Exercise and Sport, 64*(2), 127 - 133.

Bauman, A., Sallis, J., Dzewaltowski, D., Owen, N., (2004). Updating the Evidence that Physical Activity is Good for Health: An Epidemiological Review 2000-2003. *Journal of Science and Medicine in Sport, 7*, 6 - 19.

Beighle, A., Morgan, C. F., Le Masurier, G., & Pangrazi, R. P. (2006). Children's Physical Activity During Recess and Outside of School. *Journal of School Health, 76*(10), 516-520.

Berenson, G. S., Srinivasan, S. R., Bao, W., Newman, W. P., Tracy, R. E., & Wattigney, W. A. (1998). Association Between Multiple Cardiovascular Risk Factors and Atherosclerosis in Children and Young Adults. *New England Journal of Medicine, 338*(23), 1650-1656.

Brockman, R., Jago, R., & Fox, K. R. (2010). The Contribution of Active Play to the Physical Activity of Primary School Children. *Preventive Medicine, 51*(2), 144-147.

Bryant, M., Lucove, J., Evenson, K., & Marshall, S. (2007). Measurement of Television Viewing in Children and Adolescents: A Systematic Review. *Obesity Review, 8*, 197 - 209.

Bryant, M., Ward, D., Hales, D., Vaughn, A., Tabak, R., & Stevens, J. (2008). Reliability and Validity of the Healthy Home Survey: A Tool to Measure Factors Within Homes Hypothesized to Relate to Overweight in Children. *International Journal of Behavioral Nutrition and Physical Activity, 5*(1), 23-34

Butte, N. F., Christiansen, E., & Sorensen, T. I. A. (2007). Energy Imbalance Underlying the Development of Childhood Obesity. *Obesity, 15*(12), 3056-3066.

Centers for Disease Control and Prevention (CDC) (2010). Physical Activity for Everyone—How Much do You Need? Retrieved March 21, 2012, from http://www.cdc.gov/physicalactivity/everyone/guidelines/index.html

Chomitz, V. R., Slining, M. M., McGowan, R. J., Mitchell, S. E., Dawson, G. F., & Hacker, K. A. (2009). Is There a Relationship Between Physical Fitness and Academic Achievement? Positive Results From Public School Children in the Northeastern United States. *Journal of School Health, 79*(1), 30-37.

Corder, K., Sallis, J. F., Crespo, N. C., & Elder, J. P. (2011). Active Children Use More Locations for Physical Activity. *Health & Place, 17*(4), 911-919.

Craggs, C., Corder, K., van Sluijs, E. M. F., & Griffin, S. J. (2011). Determinants of Change in Physical Activity in Children and Adolescents: A Systematic Review. *American Journal of Preventive Medicine, 40*(6), 645-658.

Crawford, D., Timperio, A., Campbell, K., Hume, C., Jackson, M., Carver, A., & Salmon, J. (2008). Parent's Views of the Importance of Making Changes in Settings Where Children Spend Time to Prevent Obesity. *Asia Pacific Journal of Clinical Nutrition, 17*(1), 148-158.

Davison, K., & Lawson, C. (2006). Do Attributes in the Physical Environment Influence Children's Physical Activity? A Review of the Literature. *International Journal of Behavior Nutrition and Physical Activity, 3*, 19-26.

Delissaint, D., & McKyer, E. L. (2008). Analysis of Theory Utilization Among Prenatal HIV-Testing Research. [Review]. *American Journal of Health Behavior, 32*(6), 764-770.

DiClemente, R. J., Crosby, R.A. and Kegler, M.C. (2002). *Emerging Theories in Health Promotion Practice and Research: Strategies for Improving Public Health*. San Francisco, CA.: Jossey Bass. 56-63

DiLorenzo, T. M., Stucky-Ropp, R. C., Vander Wal, J. S., & Gotham, H. J. (1998). Determinants of Exercise Among Children. II. A Longitudinal Analysis. *Preventive Medicine, 27*(3), 470-477.

Ding, D., Sallis, J. F., Kerr, J., Lee, S., & Rosenberg, D. E. (2011). Neighborhood Environment and Physical Activity Among Youth: A Review. *American Journal of Preventive Medicine, 41*(4), 442-455.

Dunton, G., Jamner, M., & Cooper, D. (2003). Assessing the Perceived Environment Among Minimally Active Adolescent Girls: validity and Relations to Physical Activity. *American Journal of Health Promotion, 18*(1), 70 - 73.

Durant, N., Harris, S. K., Doyle, S., Person, S., Saelens, B. E., Kerr, J., Sallis, J. F. (2009). Relation of School Environment and Policy to Adolescent Physical Activity. *Journal of School Health, 79*(4), 153-159.

Dzewaltowski, D. A., Geller, K. S., Rosenkranz, R. R., & Karteroliotis, K. (2010). Children's Self-Efficacy and Proxy Efficacy for After-School Physical Activity. *Psychology of Sport and Exercise, 11*(2), 100-106.

Erwin, H., Abel, M., Beighle, A., Noland, M. P., Worley, B., & Riggs, R. (2012). The Contribution of Recess to Children's School-Day Physical Activity. *Journal of Physical Activity & Health, 9*(3), 442-448.

Farley, T., Meriweather, R., Baker, E., Rice, J., & Webber, L. (2008). Where do the Children Play? The Influence of Playground Equipment on Physical Activity of Children in Free Play. *Journal of Physical Activity and Health, 5*, 319 - 331.

Fein, A., Plotnikoff, R., Wild, C., & Spence, J. (2004). Perceived Environment and Physical Activity in Youth. *International Journal of Behavioral Medicine, 11*(3), 135 - 142.

Felton, G., Dowda, M., Ward, D., Dishman, R., Trost, S., Saunders, R., & Pate, R. (2002). Differences in Physical Activity Between Black and White Girls Living in Rural and Urban areas. *Journal of School Health, 72*(6), 250 - 255.

Fisher A, H. C., Webber L, Purslow L, Wardle J. (2011). MVPA Is Associated with Lower Weight Gain in 8–10 Year Old Children: A Prospective Study with 1 Year Follow-Up. *PLoS ONE 6*(4).

Flegal, K. M., Ogden, C. L., Wei, R., Kuczmarski, R. L., & Johnson, C. L. (2001). Prevalence of Overweight in US Children: Comparison of US Growth Charts from the Centers for Disease Control and Prevention with Other Reference Values for Body Mass Index. *American Journal Clinical Nutrition, 73*(6), 1086-1093.

Flegal, K. M., Ogden, C. L., Yanovski, J. A., Freedman, D. S., Shepherd, J. A., Graubard, B. I., & Borrud, L. G. (2010). High Adiposity and High Body Mass Index-for-Age in US Children and Adolescents Overall and by Race-Ethnic Group. *American Journal Clinical Nutrition, 91*(4), 1020-1026.

Galbally, R. L. (1997). Health–Promoting Environments: Who will Miss Out? *Australian and New Zealand Journal of Public Health, 21*(4), 429-430.

Giles-Corti, B., Timperio, A., Bull, F., & Pikora, T. (2005). Understanding Physical Activity Environmental Correlates: Increased Specificity for Ecological Models. *Exercise and Sport Science Reviews, 33*(4), 175 - 1181.

Gordon-Larsen, P., McMurray, R., & Popkin, B. (2000). Determinants of Adolescent physical Activity and Inactivity Patterns. *Pediatrics, 105*(6), E83-89.

Grzywacz, J. G., & Marks, N. F. (2000). Reconceptualizing the Work-Family Interface: an Ecological Perspective on the Correlates of Positive and Negative Spillover Between Work and Family. *Journal of Occupational Health Psychology, 5*(1), 111-126.

Harrell, J., McMurray, R., Gansky. S., Bangdiwala,S., & Bradley, C. (1999). A Public Health vs a Risk-Based Intervention to Improve Cardiovascular Health in Elementary School Children: The Cardiovascular Health in Children Study. *American Journal of Public Health October, 89(10).* 1529-1535

Haug, E., Torsheim, T., Sallis, J., & Samdal, O. (2010). The Characteristics of the Outdoor Environment Associated with Physical Activity. *Health Eduction Research, 25*, 248 - 256.

Howe, C. A., Freedson, P. S., Alhassan, S., Feldman, H. A., & Osganian, S. K. (2012). A Recess Intervention to Promote Moderate-to-Vigorous Physical Activity. *Pediatric Obesity, 7*(1), 82-88.

Huang, Y.-J., Wong, S., Salmon, J., & Hui, S. (2011). Reliability and Validity of Psychosocial and Environmental Correlates Measures of Physical Activity and Screen-Based Behaviors Among Chinese Children in Hong Kong. *International Journal of Behavioral Nutrition and Physical Activity, 8*(1), 16-22.

Huberty, J. L., Siahpush, M., Beighle, A., Fuhrmeister, E., Silva, P., & Welk, G. (2011). Ready for Recess: A Pilot Study to Increase Physical Activity in Elementary School Children. *Journal of School Health, 81*(5), 251-257.

Hume, C., Salmon, J., & Ball, K. (2005). Children's Perceptions of Their Home and Neighborhood Environments, and Their Association with Objectively Measured Physical Activity: A Qualitative and Quantiative Study. *Health Education Research, 20*(1), 1 - 13.

Janssen, I., & LeBlanc, A. (2010). Systematic Review of the Health Benefits of Physical Activity and Fitness in School-Aged Children and Youth. *International Journal Behavior Nutrition and Physical Activity, 7*, 40-49.

Jones, N. R., Jones, A., van Sluijs, E. M. F., Panter, J., Harrison, F., & Griffin, S. J. (2010). School Environments and Physical Activity: The Development and Testing of an Audit Tool. *Health & Place, 16*(5), 776-783.

Kimm, S. Y., Glynn, N. W., Kriska, A. M., Fitzgerald, S. L., Aaron, D. J., Similo, S. L., & Barton, B. A. (2000). Longitudinal Changes in Physical Activity in a Biracial Cohort During Adolescence. *Medicine and Science in Sports and Exercise, 32*(8), 1445-1454.

King, A. C., Jeffery, R. W., Fridinger, F., Dusenbury, L., Provence, S., Hedlund, S. A., & Spangler, K. (1995). Environmental and Policy Approaches to Cardiovascular Disease Prevention Through Physical Activity: Issues and Opportunities. *Health Education Quarterly, 22*(4), 499-511.

Kumanyika, S. K. (2008). Environmental Influences on Childhood Obesity: Ethnic and Cultural Influences in Context. *Physiology and Behavior, 94*(1), 61-70.

Lindquist, C. H., Reynolds, K. D., & Goran, M. I. (1999). Sociocultural Determinants of Physical Activity among Children. *Preventive Medicine, 29*(4), 305-312.

Lopes, V. P., Rodrigues, L. P., Maia, J. A. R., & Malina, R. M. (2011). Motor Coordination as Predictor of Physical Activity in Childhood. *Scandinavian Journal of Medical Science of Sports, 21*(5), 663-669.

Loucaides, C. A., Chedzoy, S. M., Neville Bennett, S. M., & Walshe, K. (2004). Correlates of Physical Activity in a Cypriot Sample of Sixth-Grade Children. *Pediatric Exercise Science, 16*(1), 25-36.

Loucaides, C. A., Jago, R., & Charalambous, I. (2009). Promoting Physical Activity during School Break Times: Piloting a Simple, Low Cost Intervention. *Preventive Medicine, 48*(4), 332-334.

McAlister A, Perry. C., & Parcel G. (2008). How Individuals, Environments, and Health Behaviors Interact: Social Cognitive Theory. *Health Behavior and Health Education*. San Francisco, CA: Jossey-Bass.

McKenzie, T. L., Baquero, B., Crespo, N. C., Arredondo, E. M., Campbell, N. R., & Elder, J. P. (2008a). Environmental Correlates of Physical Activity in Mexican American Children at Home. *Journal of Physical Activity & Health, 5*(4), 579-591.

McKenzie, T. L., Crespo, N. C., Baquero, B., & Elder, J. P. (2010). Leisure-Time Physical Activity in Elementary Schools: Analysis of Contextual Conditions. *Journal of School Health, 80*(10), 470-477.

McKenzie, Thomas L., & Kahan, D. (2008b). Physical Activity, Public Health, and Elementary Schools. *The Elementary School Journal, 108*(3), 171-180.

Millstein, R. A., Strobel, J., Kerr, J., Sallis, J. F., Norman, G. J., Durant, N., & Saelens, B. E. (2011). Home, School, and Neighborhood Environment Factors and Youth Physical Activity. *Pediatric Exercise Science, 23*(4), 487-503.

Mota, J., Almedia, M., Sentos, R., Ribeiro, J.C., & Santos, M.P. (2009). Association of Perceived Environmental Characteristics and Participation in Organized and Non-Organized Physical Activities of Adolescents. *Pediatric Exercise Science, 21*, 233-239.

Motl, R. W., Dishman, R. K., Saunders, R. P., Dowda, M., & Pate, R. R. (2007). Perceptions of Physical and Social Environment Variables and Self-Efficacy as Correlates of Self-Reported Physical Activity Among Adolescent Girls. *Journal of Pediatric Psychology, 32*(1), 6-12.

Motl, R. W., Dishman, R. K., Ward, D. S., Saunders, R. P., Dowda, M., Felton, G., & Pate, R. R. (2002). Examining Social-Cognitive Determinants of Intention and Physical Activity among Black and White Adolescent Girls Using Structural Equation Modeling. *Health Psychol, 21*(5), 459-467.

Nielsen, G., Bugge, A., Hermansen, B., Svensson, J., & Andersen, L. B. (2012). School Playground Facilities as a Determinant of Children's Daily Activity: A Cross-Sectional Study of Danish Primary School Children. *Journal of Physical Activity & Health, 9*(1), 104-114.

Ogden, C. L., Carroll, M. E., Kit, B. K., & Flegal, K. M. (2012). Prevalence of Obesity in the United States, 2009-2010. *NationalCenter for Health Statistics; Data Brief* (82), 1-8.

Ogden, C. L., Wei, R., Curtin, L. R., & Flegal, K. M. (2010). The 2000 Centers for Disease Control and Prevention Growth Charts: Several Insights After 8 Years. *Nestle Nutrition Workshop for Series for Pediatric Program, 65*, 181-193; discussion 193-185.

Owen, N., Humpel, N., Leslie, E., Bauman, A., & Sallis, J. (2004). Understanding Environmental Influences on Walking; Review and Research Agenda. *American Journal of Preventive Medicine, 27*(1), 67 - 76.

Pate, R., Trost, S., Felton, G., & Ward, D., (1997). Correlates of Physical Activity Behavior in Rural Youth. *Research Quarterly for Exercise and Sport, 68*(3), 241-248.

Perry, C., Saelens, B., & Thompson, B. (2011). Intrapersonal, Behavioral, and Environmental Factors Associated with Meeting Recommended Physical Activity Among Rural Latino Youth. *Pediatric Exercise Science, 23*(4), 521-536.

Riddoch, C., Mattocks, C., Deere, K., Saunders, J., Kirkby, J., Tilling, K., & Ness, A. (2007). Objective Measurement of Levels and Patterns of Physical Activity. *Archives of Disease of Childern, 92*, 963 - 969.

Ridgers, N., Fairclough, S., & Stratton, G. (2010a). Twelve-Month Effects of a Playground Intervention on Children's Morning and Lunchtime Recess Physical Activity Levels. *Journal of Physical Activity and Health, 7*, 167 - 175.

Ridgers, N., Fairclough, S., & Stratton, G. (2010b). Variables Associated with Children's Physical Activity Levels During Recess: the A-CLASS project. *International Journal of Behavioral Nutrition and Physical Activity, 7*(1), 74-85.

Ridgers, N., Stratton, G., Fairclough, S., & Twisk, J. (2007a). Children's Physical Activity Levels During School Recess: A Quasi-Experimental Intervention Study. *International Journal of Behavioral Nutrition and Physical Activity, 4*(1), 19-26.

Ridgers, N., Stratton, G., Fairclough, S., & Twisk, J. (2007b). Long-term Effects of Playground Markings and Physical Structures on Children's Recess Physical Activity Levels. *Preventive Medicine, 44*, 393 - 397.

Ridgers, N. D., Saint-Maurice, P. F., Welk, G. J., Siahpush, M., & Huberty, J. (2011). Differences in Physical Activity During School Recess. *Journal of School Health, 81*(9), 545-551.

Rimer, B., & Glanz,K. (2005) *Theory at a Glance: A Guide for Health Promotion Practice.* National Institute of Health; US Department of Health and Human Services, 2nd edition; Retrieved March 21, 2012, http://www.cancer.gov/cancertopics/cancerlibrary/theory.pdf

Roemmich, J. N., Epstein, L. H., Raja, S., Yin, L., Robinson, J., & Winiewicz, D. (2006). Association of Access to Parks and Recreational Facilities with the Physical Activity of Young Children. *Preventive Medicine, 43*(6), 437-441.

Roemmich, J., Epstein, L., Raja, S., & Yin, L. (2007). The Neighborhood and Home Environments: Disparate Relationships With Physical Activity and Sedentary Behaviors in Youth. *Annals Of Behavioral Medicine, 33*(1), 29-38.

Ronda, G., Van Assema, P., & Brug, J. (2001). Stages of Change, Psychological Factors and Awareness of Physical Activity Levels in the Netherlands. *Health Promotion International, 16*(4), 305-314.

Rosenberg, D., Sallis, J., Kerr, J., Maher, J., Norman, G., Durant, N., & Brian, E. (2010). Brief Scales to Assess Physical Activity and Sedentary Equipment in the Home. *International Journal of Behavioral Nutrition & Physical Activity, 7*, 10-20.

Saint-Maurice, P., Welk, G., Silva, P., Siahpush, M., & Huberty, J. (2011). Assessing Children's Physical Activity Behaviors at Recess: A Multi-Method Approach. *Pediatric Exercise Science, 23*(4), 585-599.

Sallis, J., Cervero, B., Ascher, W., Henderson, K., Kraft, M., & Kerr, J. (2006). An Ecological Approach to Creating Active Living Communities. *Annual Review of Public Health, 27*, 297-304.

Sallis, J., Johnson, M., Calfas, K., Caparosa, S., & Nichols, J. (1997). Assessing Perceived Physical Environmental Variables that may Influence Physical Activity. *Research Quarterly for Exercise and Sport, 68*(4), 345-351.

Sallis, J., Bauman, A., & Pratt, M. (1998). Environmental and Policy Interventions to Promote Physical Activity. *American Journal of Preventive Medicine, 15*(4), 379-397.

Sallis, J. (2009). Measuring Physical Activity Environments: A Brief History. *American Journal of Preventive Medicine, 36*(4, Supplement), S86-S92.

Sallis, J.,Prochaska, J., & Taylor, W., (2000) A Review of Correlates of Physical Activity of Children and Adolescents. *Medicine and Science in Sports and Exercise, May 32(5),* 963-975

Salmon, J. (2010). Factors in Youth Physical Activity Participation: From Psychological Aspects to Environmental Correlates. *Research in Sports Medicine, 18*(1), 26-36.

Salmon, J., & Okely, A. (2009). Physical Activity in Young People—Assessment and Methodological Issues. *Journal of Science and Medicine in Sport, 12*(5), 513-514.

Saunders, T., Prince, S., & Tremblay, M. (2011). Clustering of Children's Activity Behaviour: The Use of Self-Report Versus Direct Measures. *International Journal of Behavioral Nutrition and Physical Activity, 8*(1), 48-58.

Singh A., (2012). Physical Activity and Performance at School: A Systematic Review of the Literature Including a Methodological Quality Assessment. *Archives of Pediatric and Adolescent Medicine, 166*(1), 49-55.

Sirard, J., Nelson, M., Pereira, M. A., & Lytle, L. A. (2008). Validity and Reliability of a Home Environment Inventory for Physical Activity and Media Equipment. *International Journal of Behavior, Nutrition and Physical Activity, 5*, 24-29.

Spurrier, N., Magarey, A., Golley, R., Curnow, F., & Sawyer, M. (2008). Relationships Between the Home Environment and Physical Activity and Dietary Patterns of Preschool Children: A Cross-Sectional Study. *International Journal of Behavioral Nutrition and Physical Activity, 5*(1), 31-43.

Stathi, A., Gillison, F., & Riddoch, C. (2009). Opportunities and Challenges in Physical Activity Research in Young People. *Journal of Science and Medicine in Sport, 12*(5), 515-517.

Stokols, D. (1992). Establishing and Maintaining Healthy Environments: Toward a Social Ecology of Health Promotion. *American Psychologist, 47*(1), 6-22.

Stucky-Ropp, R., & DiLorenzo, T. (1993). Determinants of Exercise in Children. *Preventive Medicine, 22*, 880 - 889.

Swinburn, B., Egger, G., & Raza, F. (1999). Dissecting Obesogenic Environments: The Development and Application of a Framework for Identifying and Prioritizing Environmental Interventions for Obesity. *Preventive Medicine, 29*(6 Pt 1), 563-570.

Telford, A., Salmon, J., Timperio, A. F., & Crawford, D. A. (2005). Examining Physical Activity Among 5- to 6- and 10- to 12-Year-Old Children: The Children's Leisure Activities Study. *Pediatric Exercise Science, 17*(3), 266.

Timperio, A., Ball, K., Salmon, J., Roberts, R., Giles-Corti, B., Simmons, D., & Crawford, D. (2006). Personal, Familial, Social and Environmental Correlates of Active Commuting to School. *American Journal of Preventive Medicine, 30*(1), 45 - 51.

Timperio, A., Crawford, D., Telford, A., & Salmon, J. (2004). Perceptions About the Local Neighborhood and Walking and Cycling Among Children. *Preventive Medicine, 38*(1), 39 - 47.

Timperio, A., Salmon, J., Ball, K., Baur, L. A., Telford, A., Jackson, M., & Crawford, D. (2008). Family Physical Activity and Sedentary Environments and Weight Change in Children. *International Journal of Pediatric Obesity, 3*(3), 160-167.

Trost, S., Kerr, L., Ward, D., & Pate, R. (2001). Physical Activity and Determinants of Physical Activity in Obese and Non-Obese Children. *International Journal of Obesity and Related Metabolic Disorders, 25*, 822 - 829.

Trost, S., Pate, R., Saunders, R., Ward, D., Dowda, M., & Felton, G. (1997). A Prospective Study of the Determinants of Physical Activity in Rural Fifth-Grade Children. *Preventive Medicine, 26*(2), 257 - 263.

Trost, S., Pate, R., Ward, D., Saunders, R., & Riner, W. (1999). Determinants of Physical Activity in Active and Low-Active, Sixth Grade African-American Youth. *Journal of School Health, 69*(1), 29 - 34.

Veitch, J., Bagley, S., Ball, K., & Salmon, J. (2006). Where do Children Usually Play? A Qualitative Study of Parents' Perceptions of Influences on Children's Active Free-Play. *Health and Place, 12*(4), 383-393.

Verstraete, S., Cardon, G., De Clercq, D., & De Bourdeaudhuij, I. (2006). Increasing Children's Physical Activity Levels During Recess Periods in Elementary Schools: The Effects of Providing Game Equipment. *European Journal of Public Health, 16*, 415 - 419.

Wechsler, H., Devereaux, A., Davis, M., & Collins, J. (2000). Using the School Environment to Promote Physical Activity and Healthy Eating. *Preventive Medicine, 31*(S), 121-137.

Willenberg, L., Ashbolt, R., Holland, D., Gibbs, L., MacDougall, C., Garrard, J., & Waters, E. (2010). Increasing School Playground Physical Activity: A Mixed Methods Study Combining Environmental Measures and Children's Perspectives. *Journal of Science and Medicine in Sport, 13*(2), 210-216.

World Health Organization (WHO)(2010). Global Recommendations on Physical Activity for Health Retrieved April 1, 2012, from http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/index.html

World Health Organization (WHO)(2011). Physical Activity and Young People Retrieved April 2, 2012, from http://www.who.int/dietphysicalactivity/factsheet_young_people/en/index.html

Zask, A., van Beurden, E., Barnett, L., Brooks, L., & Dietrich, S. (2001). Active School Playgrounds - Myth or Reality? Results of the "Move It Groove It" Project. *Preventive Medicine, 33*, 401-408.

Ziviani, J., Wadley, D., Ward, H., MacDonald, D., Jenkins, D., & Rodger, S. (2008). A Place to Play: Socioeconomic and Spatial Factors in Children's Physical Activity. *Australian Occupational Therapy Journal, 55*(1), 2-11.